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Welcome!



BY THE TIME you read this, it will be around two-and-a-half months since Windows 10 was finally released. We saw our first set of Windows 10 desktop PCs last month, but it's taken a

bit longer for the first laptops to arrive. It seems it has taken manufacturers a little more time to get Windows 10 working properly with the wide variety of modern laptop designs, with their high-pixel-density displays and detachable touchscreens.

Enough Windows 10-certified laptops have now arrived for us to put together a comprehensive group test. One of the laptops we've tested this month ships with Windows 10, while the others come with Windows 8 and, with one exception, upgrade flawlessly to Microsoft's latest operating system. We've reviewed powerful general-purpose models, versatile convertibles, incredible-value netbooks and a selection of hybrids: PCs that are both a tablet and a laptop in one. With prices from £160 to £700, there's a specification and design here for you, starting on page 78.

Gordon Moore. Businessman, Intel co-founder, multi-billionaire. He's quite a chap, but he's probably best known for his

eponymous Law. The gist is that the number of transistors on a mainstream processor, and therefore the chip's processing power, will double every year. This prediction has held remarkably true for half a century – but is it really a prediction or, if the processor industry actually saw the Law as simply a target to follow, did it hold back progress? We investigate, starting on page 94.

From operating systems to smartphones, the tech industry certainly loves a bit of hype. Recently, a great deal of buzz has surrounded a three-letter acronym: IoT, or the Internet of Things. This is the process of connecting everyday objects to the internet to enhance their capabilities; from washing machines to heating controls to light switches, the IoT is meant to bring you a fully-connected smart home to make your life infinitely easier.

But where are these smart homes? Outside of purpose-built show homes, we've never seen one. From page 102, we investigate why the smart home and the Internet of Things have been so slow to take off, and see if the IoT is destined to remain the Next Big Thing in perpetuity.

Chris Finnamore, Editor

chris@computershopper.co.uk

MEET THE TEAM

QUESTION OF THE MONTH

Following on from Moore's Law, what tech laws do you think will hold true for the future?



Chris Finnamore

“BT's Law: Broadband speeds will increase threefold every year everywhere apart from your street”



David Ludlow

“Microsoft's Law: Your computer will always update and reboot at the least convenient time”



Katharine Byrne

“Moreismore Law: Phones will continue to grow in size until we're all walking around with Motorola DynaTACs”



Michael Passingham

“Snore's Law: Product launches will get ever longer and duller until the entire audience falls asleep”



Seth Barton

“Shopper's Law: The cheapest UK retailer for a given product will always run out of stock just after we go to press”



Tom Morgan

“Steve's Law: If Apple gives an already-common feature or component a fancy name, it must have invented it”



Richard Easton

“Law of diminishing returns: Each year's model will be 50% more expensive but only 10% better than the last”

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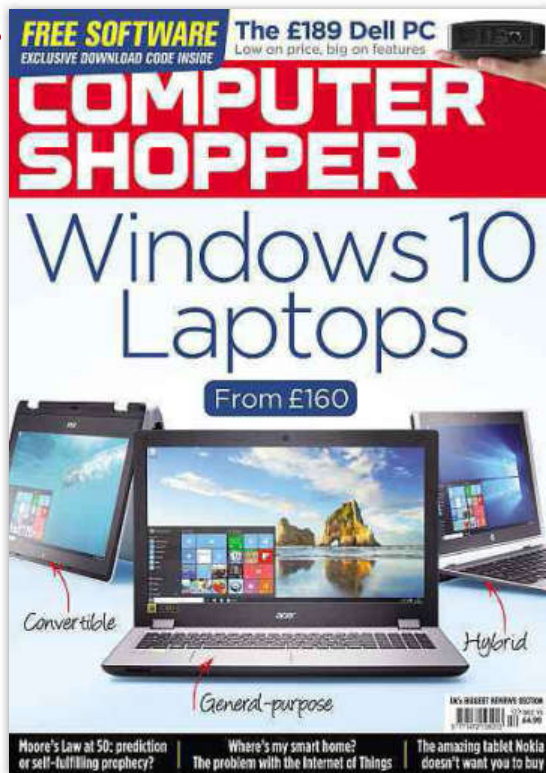
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**CALL 0844 844 0031
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Contents



p74

p35

p78

p94

p28

p102

Regulares

6 Letters

Your regular missives of wit and wisdom

10 Under Development

From wasps to Python, there's no venomous animal **David Robinson** can't handle

12 Cybercop

Data breaches by hackers are getting more frequent and much more serious. At least the government is doing something to help, says **Gordon Holmes**

14 Rants & Raves

We can't get no satisfaction at *Computer Shopper*, as the frustrated **Mel, Chris, Tom** and **Katharine** demonstrate

22 InDepth

Fancy importing a hard-to-buy bit of electronic kit to the UK? Don't hand over your cash until you've read our guide to grey imports

146 Zygote

In a world where Noel Edmonds flogs immortality, your fridge gives your Gmail account to hackers and Vodafone spies on holidaymakers, the only protection is a stun gun-equipped iPhone case, says **Zygote**

News

16 Newfile

Our monthly round-up of the latest technological events

Learn

128 Boost Windows 10 battery life

131 Use Windows 10's Safe Mode

132 Business Help

Our resident expert answers those persistent software queries

134 Helpfile

Step this way for all your hardware and Windows problems

136 Advanced Projects

We show you how to use your NAS to listen to your music anywhere in the world for free

139 Multimedia Expert

If you want to create something really special, you should use a professional printing service. **Ben Pitt** explains all you need to know

143 App Creative

Quark's DesignPad app is a great way to create impressive publishing layouts on your iPad, as **Ben Pitt** demonstrates

Features

94 50 years of Moore's Law

It's half a century since Gordon Moore made his famous pronouncement that the number of transistors in a microprocessor would double every year. But was it a prediction, or simply a target followed by the industry?

102 Where's my smart home?

The buzz around the Internet of Things shows no sign of abating, but is it all hype? We go in search of the elusive connected smart home

110 Ultra HD explained

Full HD is so 2006. The future is Ultra HD. But what exactly is it, how can you get it and is it worth buying a new TV for? We find out

114 Data after death

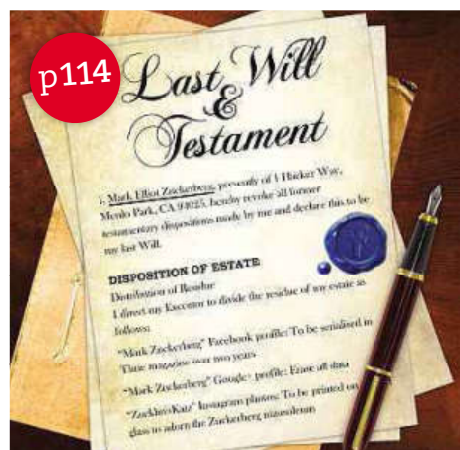
Planning what will happen to our data after we die is something we all need to think about. We explain the steps you need to take to safeguard your online legacy

119 Ultimate guide to Instagram

It's not just for hipsters and youngsters; Instagram is a great way for anyone to shoot photos and video and share them online. We show you how to get the most out of it

124 Faceblock

Facebook may be a great way to keep in touch, but there's always the danger you'll be hassled by people you'd rather ignore or annoyed by friends posting drivel. We show you how to control who has access to your posts and the degree of nonsense you have to endure



Reviews

24 This month's hot product

The third iteration of Motorola's excellent Moto G smartphone continues to impress, even if the price has risen yet again



26 Handhelds

Nokia's N1 (p28) is a great Android tablet – but you'll have to jump through hoops to get one

32 PCs & Laptops

We test two PCs from Dell and Wired2Fire at opposite ends of the power spectrum

36 Photography

Fujifilm's X-T10 (p38) concentrates on what's important: producing magnificent still images

39 Displays

BenQ's EW2750ZL (p40) proves you don't have to spend a fortune to get great image quality

42 Home Cinema

The Philips 55PFT6510/12 (p44) is a feature-packed set powered by Android TV

47 Audio

Pump up the volume with a Bluetooth speaker from the Ministry of Sound

48 Video

An action cam with every accessory imaginable

52 Printers & Scanners

Canon's Pixma MX495 doesn't sacrifice image quality or performance for its extra features

53 Networks

Nest's first IP camera is delightfully easy to use thanks to a comprehensive smartphone app

54 Storage

Toshiba's Canvio AeroCast is perfect for adding storage to desktop or mobile devices

56 Components

MSI's Radeon R7 370 shows how stock graphics card overlocks are a great way to get extra performance

59 Software

Corel's PaintShop Pro finally gets high-quality Raw processing, giving it a leg up over the competition

62 Games

We infiltrate 1980s Afghanistan in the name of world peace, in the fabulous Metal Gear Solid V: The Phantom Pain

64 Best Buys

Looking for the best kit we've reviewed recently? It's all in our Best Buys section

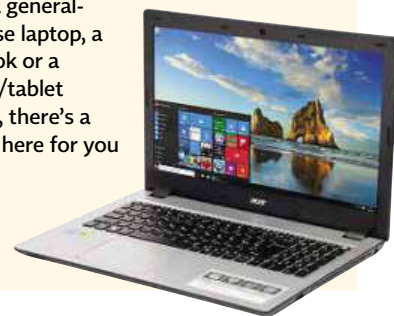
72 How We Test

Our comprehensive tests, ratings and awards explained

Group Test

78 Windows 10 laptops

It's taken a while, but we're finally starting to see laptops certified to work with Windows 10. We've tested 10 laptops of all different shapes and sizes, with prices ranging from £160 to £700. Whether you want a general-purpose laptop, a netbook or a laptop/tablet hybrid, there's a model here for you



74 Your software*

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Letters


Windows 10 has seized the imagination and attracted the ire of many a *Shopper* reader this month, as installations fail, components lack drivers and patches insist on installing themselves without so much as a by your leave

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HOW LONG IS A LIFE?

 I was rather dismayed to read in your Windows 10 article ('The Ultimate Guide To Windows 10', *Shopper* 332) that Microsoft is offering the upgrade from Windows 7 or 8 "for the life of the device".

I have a number of PCs, all running Windows 7. So far I've only upgraded one to Windows 10 to try it out, as I really didn't like Windows 8. The upgraded PC is a Dell Inspiron 1525 dating from October 2008, which originally shipped with Vista. As the machine is now seven years old, how long can I run Windows 10 before Microsoft deems in its wisdom that my laptop has reached "end of life". Moreover, how will it determine that? Will I suddenly switch the machine on one day to find that it won't launch Windows?

This will be well after the one-month trial, so a simple rollback to Windows 7 won't be an option. As I did a fresh install of Windows 7 on a new hard disk (the previous HDD had failed), I could still reinstall Windows 7, but the hours of downloading all the updates, not to mention my installed programs, fills me with dread. That's if the updates to Windows 7 are still available.

Do you know what Microsoft means when it says "for the life of the device"? Until I have more information about this upgrade and the implications for the future, I think I'll hang back and see what happens.


Brian Jones

The muddled waters around this issue are finally starting to clear. In effect, Microsoft has committed to supporting

Windows 10 until 2025. There's a caveat to this support, however. You will need the latest version of Windows 10 installed in order to receive updates (as is the case with Windows 8 and Windows 8.1). These updates will be free but, according to Microsoft, "A device may not be able to receive updates if the device hardware is incompatible, lacking current drivers or otherwise outside the Original Equipment Manufacturer's ("OEM") support period."

Essentially, if your computer's manufacturer has decided not to release device drivers for a certain version of Windows 10, you won't be able to upgrade, and at some point will no longer be able to receive security updates. What we really need to know is how often Microsoft will release major new versions of Windows 10 that are sufficiently different to require new drivers. We very much doubt that Microsoft will suddenly pull the plug and stop you logging into your PC, though.

DRIVER ME CRAZY

 Just over two years ago I bought a Dell XPS 2710 direct from Dell, together with its three-year premium support, having seen a review in *Computer Shopper*. I bought the computer because I wanted a premium future-proof all-in-one that would last a long while, and because I don't subscribe to the Apple philosophy of control.

Although I didn't think Windows 8 was as bad as many people believe, I did look forward to the introduction of Windows 10 and its philosophy as an evolving operating system. So



when Windows 10 was released I waited eagerly for the Windows app to tell me that the system was ready to install. However it was not to be. Dell in its wisdom has decided not to update the drivers of the XPS 2710 and even goes so far as to advise its customers not to install Windows 10 on this computer. I have tried both its support and customer service people to find out why Dell isn't prepared to support the upgrade on what is, after all, a fairly new premium consumer computer, but the only response I've had is that this PC was built for Windows 8 and Dell won't support such an upgrade. No one can say why and no one is prepared to do anything about it.

I don't know if *Computer Shopper* can find out anything more from Dell, but the company's attitude and indifference to the needs of its customers is disappointing to say the least, and it's surely bad business practice to abandon key customers. I, and many other people, will not be recommending Dell in future.

Nigel Hartley


It seems that the 2710 requires several drivers that are not present in Windows 10. Some

people have tried to install Windows 10 from scratch, and with some success, but problems have been reported with everything from the touchscreen to the wireless card, so we wouldn't recommend it.

It's a disappointing situation, which reminds us of Intel's failure to provide Windows 8 drivers for a number of its graphics chipsets. Dell does have an excuse in that it doesn't actually manufacture many of the components inside its computers or write the Windows drivers. If Atheros, which apparently makes the 2710's wireless card, hasn't released a Windows 10 driver, for example, Dell won't be able to provide one on its website.


We agree that it's frustrating, but the best thing to do is wait and see if the relevant drivers become available. Windows 8 will be supported until 2023, so at least you won't have to worry about security updates.

FOIBLE FIXING

 Having bludgeoned my way through Microsoft's attempts to stop me upgrading to Windows 10 (first no Windows 10 system tray icon, then the message "The installation failed in the SAFE_OS phase with an error

★ Star letter

WIND-WOES

 Having upgraded five different computers to Windows 10 over the past couple of weeks, I thought I'd write and share my experiences. The short story is that so far not one has gone through and been working 100% correctly at the end. Some have had problems I've been able to fix or work around, but I can imagine a typical person would be struggling and frustrated.

The first to be upgraded was an old HP desktop that I had running the Insider Preview version of Windows 10. It worked fine for the primary user after the upgrade, but the second user had the US keyboard layout applied. No amount of fiddling with the settings has fixed this yet, but it's the sort of thing you can live with and I haven't spent much time on it.

The second installation, on a six-year-old Dell Studio desktop, seemed to go well until I tried to set up a second user account. This resulted in an error message when I tried to log in to the new account, with no folders created for the new profile. Apparently, you have to create the account before performing the upgrade, or do a clean install and start again. Be warned. I'm living with one account on this PC for now.

The third, an Acer Aspire netbook, also seemed to go well, until the user tried opening and resaving some documents. This revealed that the file permissions on the user account were all messed up and the folders and files seemed to be read-only. Trying to change the status of the files didn't help, so I tried the

security settings for the folders, giving the user full access instead of the restricted access indicated in the table. This didn't work either. The fix I found for it was to copy all the files to a memory stick, delete the originals and move the Documents folder to a new location before moving the files back again. Unfortunately, the problem came back after a reboot. The only sure and easy way to fix it and some of the other problems was to restore Windows to its factory defaults and start over again.

The fourth PC, a 7in Connect Windows 8.1 tablet, also suffered from the file permissions problem. The fifth one was a relatively new Toshiba C50D-B-120 laptop. On this one the touchpad and buttons stopped working after the user logged in, but fortunately the temporary work around was to plug in a mouse, and the fix was as easy as downloading a more up-to-date driver from Toshiba's website. No appropriate driver was available from Microsoft. So should you upgrade or not? I leave it to you to decide, but don't expect an easy ride.

Peter Key

That's quite a selection of problems, and certainly far more than we've experienced in the office. We covered the most common problems in our feature last month (see 'Windows 10 Fixed', *Shopper* 333), but as your letter shows, there's always more ground to cover. If any readers would like to write in with their upgrade problems, we can address the most common ones in *Computer Shopper's* How To section.

during boot operation" when I installed), I quickly found three fundamental flaws in the operating system's default state that would leave a novice floundering.

First, the default email application offers only a conversation view, which quickly had me confused, with lost emails and drafts in my Sent Items folder. A novice user will struggle with that, and won't know how to resolve it (is there an alternative app that offers a simple list of emails?).

Second, the default browser provides very limited options as to what happens when you open a new tab. Granted, a novice might not use tabs, but if they do, they'll struggle to fix that (install another browser, and make it the default). Third, searching is tied to Bing, a search engine that your recent research showed housed adverts linking to malware. I tried

selecting the option to change the search engine, and it offered me the alternative of – you guessed it – Bing. Now, I'm sure that somewhere in Control Panel there's a way of installing an alternative search engine and making it the default, but again, a novice user will give up at the point where they're offered Bing or Bing – if they even realise they need an alternative.

So there we have it. A novice user who upgrades to Windows 10 will be stuck with an email app they can't use, a browser that annoys and a potentially dangerous search engine. While I suspect Windows 10 is a good upgrade once you've resolved these sorts of issues, I'm surprised that your reviews and articles to date haven't even mentioned them. Most of your users aren't novices, but many of us are the people novices turn to for advice, and if you recommend Windows 10

without qualification, so will we. If we're going to look good, we need you to tell us the truth.

Graham Hodson

These aren't so much problems with Windows 10 as annoyances with some of the applications that come with the operating system. One of the advantages of a PC (compared with, say, an iPad) is that it's incredibly simple to install alternative applications if you don't like the ones supplied with the operating system. For example, no-one in the *Shopper* office uses Edge as their main browser, preferring Chrome or Firefox instead.

The problems you mention above are easy to fix, however. To disable the conversation view in Mail, click the cog at the bottom-left to open the Settings menu, click Options and under 'Show messages arranged by conversation' slide the switch to Off. To change the default search

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AWARD WINNING PC SYSTEMS



in the Edge browser, go to the search engine you want (such as duckduckgo.com) and either click the 'Set DuckDuckGo as your default search engine' button at the bottom or open the Settings menu, click View Advanced Settings and 'Search in the address bar with', then select <Add New>. The search engine page you're currently on will be listed at the top.

PUSHY PATCHES

 Your 'Windows 10 Fixed' article (*Shopper 333*) was welcome, but I feel that another feature of this OS should have been mentioned, namely Automatic Updates. This is set to enable Microsoft to download and install updates in the background with no intervention from the user. I object to giving third parties carte blanche to install whatever they like on my computers, so have always chosen the option to 'Inform me when updates are available but let me choose when to install them', available on previous Windows versions. This doesn't seem to be available any more, unless it's well hidden, and a brief trawl on Google came up with several solutions, some a bit flaky and others involving going into the Registry to make alterations, which I don't really want to do.

Surely there must be a more elegant solution to this lurking within the bowels of the OS, as




Faster fibre is rolling out, but some green boxes will never be upgraded

I'm sure I can't be the only one concerned about this?

Richard Najdich


We agree that this is an odd choice from Microsoft, but it may be fundamental to the way the operating system works with its rolling upgrades. One method is to tick the Defer upgrades box, which will at least postpone major changes. We'd recommend leaving Automatic Updates turned on, though, as an unpatched Windows installation is open to all kinds of malware.

GREEN WITH ENVY

 When I read news items like 'BT trials 330Mbit/s G.fast fibre' (*News, Shopper 333*) it makes my blood boil. In 2010 fibre cables were laid in our village and parts of the village now have superfast broadband. On the other hand we have a small BT box near us that Openreach has said may never

be upgraded due to its size. BT should make sure as many homes as possible get a decent broadband speed before rolling out faster speeds to those who already get high speeds. My average broadband speed with BT is 1.5Mbit/s so the fastest I get is 2.5Mbit/s if I'm lucky. This rarely gives me a good steady picture on Chromecast for BT Sport, the only way of getting its sports channels without fibre.

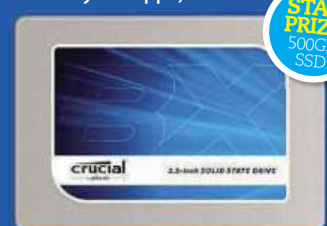
Mike Rose

BT evidently feels it can make more money selling ever-faster broadband to high-density areas than making sure rural dwellers have half-decent broadband. As we showed in our 'Fibre for all' feature (*Shopper 324*), sometimes the only way is to bypass BT and set up a company to lay fibre yourselves – or even set up a high-powered wireless network to cover the parts of the village that can't get fibre. 

WRITE IN AND WIN

Do you wish your computer was faster when booting and loading applications? Thanks to Crucial, you can achieve your dream of a faster PC or laptop with the BX100 SSD. The writer of our Star Letter will be awarded one of these solid-state devices, which can be installed in a desktop PC or a laptop.

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NEXT MONTH

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After decades of cash and card dominance, the way we pay is changing. We explain why the rise of Bitcoin and Apple Pay matters.

› IS THE NET KILLING THE PLANET?

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Bugging out

Some problems in business can have a real sting in the tail, but **David Robinson** is equipped with a stuttering spray can, a long stick and a talent for getting stuck in



DAVID ROBINSON
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RUNNING A SOFTWARE

development enterprise presents a host of challenges that span the spectrum, from maintaining a long-term strategy at one end to the most mundane everyday tasks at the other. Our principal long-term concern is choosing a development methodology that will serve customers working both in the office and on the move, while also being as 'device agnostic' as possible. The chief mundane mission this month has been dealing with a wasps' nest.

The nest is in a shed at the back of the office where we keep any packaging awaiting recycling. It's a huge nest, filling a box that contained a wall rack cabinet. I still had some wasp spray that worked well on a similar nest last year. Hoping to repeat the feat, I sprayed it into one of the box's hand holes – but after three splutters it gave up. A trip to B&Q was fruitless, so I ordered a great big can from eBay.

Having taken the first step to solve my mundane problem, I turned to the strategy problem. Decent commercial offerings for development are few and far between, so I've been playing with Python and Python-based web frameworks. Progress has

Most of the books and tutorials, both in print and online, use Unix or Linux examples. If there are any Windows references they're often inaccurate, out of date or a half-arsed fudge. Some Windows procedures only seem to work if you wait for the full moon, then dance naked while singing *Fight The Good Fight* backwards. I could put Linux on a spare machine but that would mean having another screen on the desk or creating X-Terminal links, as you would when working with a 'crustless' Raspberry Pi (see *Under Development*, Shopper 304).

HYPER-VENTILATION

I ask engineer Garry if he has a virtual machine with Linux already installed. *Mirabile dictu* – he does. The bad news is that he prepared it using Microsoft's Hyper-V, and I run VMs on the Lenovo using VMware. No problem, says Garry, just go into Control Panel and enable Hyper-V. Well, I would if the option were there! I'm running Windows 8 Home, and you need Pro to run Hyper-V. It's a choice between forking out £100 for an upgrade that turns Hyper-V on or devoting precious time to creating an Ubuntu VMware installation. I opt for the easier route. Garry says he'll do the Windows 8 Pro update while I deal with the wasp nest. He knows which tasks to pick.

Ten days after ordering the wasp spray from eBay, it still hasn't arrived. Meanwhile the staff are whingeing about wasps so I decide to try dumping some ant powder through the hole in the box. That significantly stems the volume of wasps flying out of the hole. Then I get a long pole, poke it through the hole and carry the box out at arm's length to the far side of the car park bordering a field. I was only stung once in the process.

When I return I find Garry's still 'upgrading' the Lenovo. The screen is blue with a message

that says 'restarting your system'. After 45 minutes it still says 'restarting your system' and the infuriating circle of marching dots is going round and round. This icon is virtually useless. All it tells you is that the hardware is on and possibly doing something. Microsoft's progress bars may offer laughably inaccurate time estimates but at least you know you're not stuck in an endless loop going nowhere.


We decide on a forced reboot. After a tense 15 minutes we finally get a logon screen. Phew! Regular readers will remember the horrors suffered last year when a Microsoft update killed my previous laptop, so you can understand the apprehension.

Enabling Hyper-V was simply a matter of going to Control Panel and ticking a box. The only configuration I had to do was to set up a virtual network card in Hyper-V's manager panel. Almost worth £100.

Under Ubuntu I was able to construct a Python virtual environment, download Django, the Edge extension and PostgreSQL and construct a skeleton website in no time. Trying that in Windows 8 had involved days of faffing and failing to produce an acceptable result. The hunch about moving the development tests to Linux proved a good one.

WIND DOWN WINDOWS

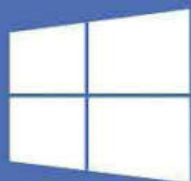
I've heard mixed reports about Windows 10 and some horror stories about upgrading from 8, so I'm seriously considering testing Ubuntu for general use on the Lenovo. Many of the applications I use are available on Linux – OpenOffice, Thunderbird, Chrome – but others, such as Ecco and Cakewalk Sonar, are not. Decisions, decisions. Maybe the answer is another VM.

At least I solved the wasp problem. My errant eBay spray can finally arrived. Just in time for next year. 

The staff are whingeing about wasps so I decide to try dumping some ant powder through the hole in the box

been a case of two steps forward, one step back – and sometimes one forward and two back. Web2Py looked promising but turned out to be hopeless. Experiments with Django have been more productive but I still keep hitting 'environmental' issues that make life difficult.

I've come to the conclusion that much of this is due to Windows just not being a natural home for serious Python use.



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Too much monkey business

As yet another high-profile attack hits a major website, **Gordon Holmes** reports on a new government scheme that aims to protect small businesses against cyberattacks



GORDON HOLMES

With more than 30 years of experience in law enforcement, our retired cop gives a police officer's perspective on the sticky subject of cybercrime
letters@computershopper.co.uk

ANOTHER MONTH, ANOTHER

data breach. Most of you will have seen reports of a group of hackers calling themselves 'The Impact Team' who released details of 33 million accounts allegedly registered with the online infidelity site Ashley Madison. Apparently the hackers took exception to the dubious morality of a website that encouraged its members to commit adultery and stole a reported 300GB of data.

The Canadian police are conducting enquiries into the hack as well as the subsequent release of members' account details. Having worked closely with the Mounties in the past, I know them to be efficient, cyber-savvy and extremely persistent. It's true: they always get their man (or woman).

However, in reality there are far more breaches, where web servers are hacked and stolen account details are posted, than those we read about in the papers. On the side of the good guys are a number of 'white hat' researchers who make it their mission to identify potentially vulnerable websites and contact site administrators to warn against the flaw, so giving them

For those of you who haven't heard of it, *pastebin.com* is one of a number of pasting sites that have long been used by members of the programming community to post plain text (known as 'pastes') and to share source code or other coding snippets. However, the ability to use the site anonymously made the site a bragging ground for hackers.

My contact had found what appeared to be the contents of an insecure server. The paste included full details of emails, usernames, passwords and orders made with a particular small business in the UK. My friend's dilemma was whether he should inform the data owner of this compromise, and we agreed that letting the company know was the best thing to do.

FUEL INJECTION

We then contacted the third arm of our security triumvirate: another trusted colleague with extensive experience in the identification and remediation of server breaches. He was able to quickly identify that the business server was vulnerable to SQL injection attacks. He thought it highly likely this kind of attack had occurred, resulting in the attacker being able to bypass the normal admin login and access the company's database directly.

This tale has a bittersweet ending; our server expert was able to advise the company as to how to beef up the server to reduce the chances of attacks like this happening in future, but this still left the business owner with the prospect of contacting his compromised customers to explain what had happened. I hope this chap doesn't suffer too much reputational damage. Let's face it, the real problem lies with his web host, not with him.

The business concerned was operating in the same way as hundreds of other small businesses; growing its customer base and concentrating on

delivering its core services to the best of its ability. The problem is that, with no available budget for cybersecurity and an absolute requirement to operate using the internet, businesses such as this are ripe for targeting by the small-minded yet tech-savvy idiots seeking to increase their 'kudos' rating among their equally small-minded peers.

JUST THE ESSENTIALS

A government initiative, called Cyber Essentials, aims to raise cybersecurity levels within organisations. The initiative is backed by the Federation of Small Businesses, the CBI and a number of insurance organisations who offer incentives for businesses that implement the scheme.

Cyber Essentials is described as low-cost and light-touch, and defines a set of controls which, when properly implemented, provide organisations with basic protection from the most prevalent forms of internet-based threats. In particular, it focuses on threats that are widely available online and require low levels of attacker skill.

Businesses are independently assessed and then helped to achieve certification, so demonstrating to potential customers that they are safe to trade with. I anticipate that this basic standard of business cybersecurity will become mandatory in certain areas, particularly when dealing with government contracts.

If you run a small business and you don't have a large cybersecurity budget at your disposal, therefore, relatively low-cost assistance is available. Go to www.gov.uk and use the search term Cyber Essentials: there's plenty of worthwhile reading there. Let's face it: it's unlikely my friends and I will be around with free advice should you be the next unfortunate victim of a data breach. **CS**

If you run a small business and you don't have a large cybersecurity budget, relatively low-cost assistance is available

the opportunity to plug the security hole. However, there would also seem to be a large number of commercial sites whose administrators are more concerned with the bottom line than the security of their users.

This situation was brought to my attention recently when one of my contacts in the cyber-intelligence field called to ask what I thought about a post he had found on www.pastebin.com.

Cyberpower recommends Windows.



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Cortana available in select markets at launch, experience may vary by region and device.
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Work easy. Play hard. Windows

RANTS & RAVES

The need to have their desires satisfied has landed would-be adulterers in hot water, gamers in plot limbo and *Shopper's* editor in a cavernous shopping centre in Purley

Mel Croucher

RANTS

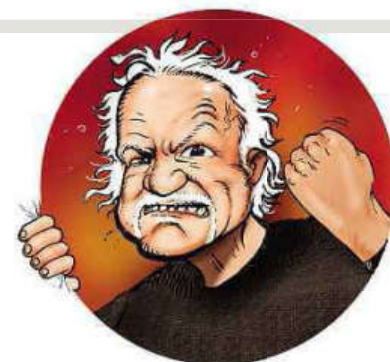
Technology has long been used to exploit male urges for profit, but Mel advises men to keep their hands well out of their pockets

THE FACT THAT many men use technology for sexual frisson is nothing new. And neither is the fact that their search for sexual gratification is used to rip them off. It's a voluntary testosterone tax. As a lad I remember aching to see my first photo of a Completely Naked Lady, as advertised on the grubby card of a peep-show machine at the dark end of the local pier. Eventually, I summoned the courage to insert my sixpence, which was quite an investment back then. I slid the nickel-plated shaft into the oiled slot of the device, and when the observation shutter fell open, there she was in all her glory. A crummy little black and white postcard of *The Birth Of Venus*, painted by Sandro Botticelli in 1485.

I'd been swindled by the arcade management, by the content provider and by my own crowded trousers. Which brings me to the biggest alleged swindle of modern times: Ashley Madison. I've taken considerable time and effort to examine

the hacked database of this adulterers' website, which boasts such gloriously inappropriate advertising as "have an affair, guaranteed," along with "100% Discreet Service", "Trusted Security Award" and "this is a Secure Site". I make no judgement about the men who seek extra-marital sex via this network, other than that they are as daft as I was when I spent my sixpence.

So let's start with the money. They used to say "a penny for your thoughts," but dirty thoughts cost a lot more these days. Men are charged a basic £39 to introduce their member to the online world of Ashley Madison, and £179 for "Affair Guaranteed Membership". The same services are free for women, which is where the obvious clue lies. In an echo of cynical children's apps designed to extort additional revenues, men are encouraged to buy virtual gifts and pay for virtual chats to boost their chances with women who may, just possibly, be cartoons. And the gullibility of these men is almost



overwhelming. Ashley Madison declared revenues of £79,844,503 last year. Of the detailed data and personal messages I saw concerning 39,855,361 profiles, 4,594,069 claim to represent women. Of these alleged women 4,085,458 show a zero default entry on their account timestamp, meaning their creators have never used the site.

That could suggest that around half a million supposed women are putting it about with 35 million men using the database, which would be a bit tiring. But more detailed analysis shows the number of genuine women who check bona fide messages is far lower. In other words, most of the female accounts are alleged to have been faked. Perversely, since the Ashley Madison hack and adverse publicity, hordes of new male members have signed up. The swindle of the testosterone tax hasn't changed, but the scale has mushroomed from a handful of sixpenny bits to way over eighty million quid. That's progress.

Chris Finnamore

RANTS

Internet shopping is all very well, but for babies – not known for their ability to defer gratification – sometimes only a shop will do

WE'VE JUST HAD a baby daughter. I won't bore you with the details, but she's small and eats a lot.

One immediate consequence was that I had to do a lot of shopping. No matter how well prepared we thought we were, with piles of mismatched clothes, second-hand prams we didn't know how to put up and 600-page parenting tomes to read, there were, inevitably, plenty of things missing.

This led to a mad dash up and down the Purley Way the day after we came home. The Purley Way is a large out-of-town shopping area south of London, with every major chain represented on a huge scale.

However, the main thing this shopping trip taught me, apart from to avoid Ikea at certain times of the day, is that physical shops are being left to rot.

One item in particular rammed the point home. We needed a nursing pillow. This is shaped like a broken doughnut (or a flattened horseshoe) and fits around mum's waist to prop up the baby during one of her absurdly frequent feeding sessions.

The Purley Way has a Mothercare, a Mamas & Papas, a John Lewis Home and a Babies R Us – all places you'd expect to find such an item. Indeed, go to their websites and there's a huge selection available.



With this in mind, I walked into Mothercare expecting to find a ward of nursing pillows, a Gregg's of doughnuts, a smithy of flattened horseshoes. What I found was a space on a dusty shelf with a sad-looking price sticker and no product. Mamas & Papas was even worse: rarely have I seen such a cavernous space devoted to so few objects.

I understand that shelf space is limited. I understand that businesses have to devote resources to their online offerings. But please don't forget your physical shops. There are plenty of people out there who can't wait three days for a parcel.

Tom Morgan & Katharine Byrne

RANT

Are gamers' expectations reaching crazy new heights just as publishers are losing interest?

NOT SINCE THE heady days of Pac-Man, where the 256th level couldn't be played due to limitations in the 8-bit level counter, have we seen so many blatantly unfinished games. Part of the problem is technology, part is the way games are currently funded, and part is a combination of the two.

PCs and consoles are so powerful that it's possible for games to have astounding production values, but lush and detailed 3D environments don't create themselves. Armies of modellers and artists are needed, and this adds a fortune to production costs.

This was the case with Frozenbyte's Trine 3, which arrived with fewer levels than players were expecting – mainly because the developers had spent most of their time and money making the switch from the 2D platforming that made the first two games so popular to new 3D environments. This was disappointing, as we noted in our review (see *Shopper* 333), as the game ends just as the story starts to get going.

Sometimes a publisher simply loses faith in a game or developer and pulls the plug, as happened with Metal Gear Solid V: The Phantom Pain (see page 62). While a lot is still unknown about Konami's public parting with Metal Gear developer Hideo Kojima, it seems his departure left its mark on the game's final act. If the abrupt ending to the game's second chapter wasn't bad enough, it's since been uncovered that a third chapter was in the works, which was completely cut from the final game.

Rumours are circulating that Konami is finding it increasingly difficult to make a profit from video games, and that it had decided it had pumped enough money into Kojima's grand vision of an open-world Metal Gear Solid game. When the company that finances your games decides that its future is in mobile content and Pachinko machines for Japanese arcades, there's little to do but wrap up as best you can and hope gamers will understand.



And here's the rub: gamers don't always understand. Indeed, when most games these days are billed as bigger and better than their predecessors, it's not surprising that fans have come to expect so much – which makes it all the more frustrating when those promises can't be delivered. There's also the fact that development of some titles is part-funded by gamers through pre-purchase or early-access schemes such as Kickstarter, which means they feel they have a stake in a title.

As events have shown, however, meeting such expectations isn't always possible. Some optimists hang their hopes on downloadable content (DLC) to finish the story, but Trine 3's cash-strapped developers have said this won't happen, and with cult Metal Gear developer Kojima firmly extracted from Konami HQ like a soldier strapped to a Fulton balloon, it seems fans of both games will be left wondering what might have been. **CS**

IFA

CONSUMER ELECTRONICS UNLIMITED

Computer Shopper rounds up all the highlights from this year's IFA show in Berlin

IFA IS ONE of the biggest consumer technology shows on the planet, with major manufacturers from all over the world turning up to Berlin's Messe to reveal their latest products just in time for Christmas. This year, there were more new devices on display than ever before, and we were there to see them all.

SONY SQUEEZES IN MORE PIXELS

We'd thought Samsung might be the first company to release a 4K smartphone this year, but Sony has beaten it to the punch with its brand-new Xperia Z5 Premium handset. Launching in November, the Z5 Premium is the world's first 4K smartphone and will play big brother to Sony's other new flagship devices, the Xperia Z5 and Z5 Compact, both of which are due out this month.

To make the most of its 3,480x2,160 resolution, Sony has fitted the Xperia Z5 Premium with a large 5½in display, giving it an insanely high pixel density of 806ppi. That's more than twice as sharp as the iPhone 6 Plus, which also has a 5½in screen but a resolution of 1,920x1,080. However, it remains

to be seen whether 4K will be worthwhile on such a small screen, as we found that it gave diminishing returns when we held the phone at a normal viewing distance.

Still, Sony is confident that its 3,430mAh battery will sustain the phone for the same length of time as the Xperia Z5 and Z5 Compact, claiming up to two days of normal use. It comes with an octa-core Qualcomm Snapdragon 810 processor and 3GB of RAM, as well as a 23-megapixel camera. Here the Z5 Premium lays claim to another world record, as Sony says the camera has the world's fastest autofocus, clocking in at just 0.03 seconds. Another big addition is Sony's super slim fingerprint sensor, which is built into the power button on the side of the phone.

Sony has yet to announce pricing for the Z5 Premium, but we wouldn't be surprised if it were considerably more expensive than the 5.2in Xperia Z5, which has only a 1,920x1,080 resolution. Still, if 4K sounds like overkill, the Z5 and Z5 Compact – which has a 4.7in, 1,280x720 display – share many of the same specifications as the Z5 Premium, including its chipset, camera and fingerprint sensor, so you won't miss out on much if you opt for one of Sony's smaller models.

ACER'S BUILDING BLOCKS

Earlier this year, the release of Acer's Revo One mini PC proved that you don't need to sacrifice storage space to fit a full computer in a case no bigger than a biscuit tin. Now Acer has gone one further with the Revo Build, a modular mini PC with interchangeable upgrades for adding extra storage, connectivity and even external graphics without compromising on size.

The base unit will be available first, with modules appearing for upgrades. Modules stack on top of each other with magnets and pogo pins, so there are no unsightly external cables to worry about, and with a 125mm square footprint it won't take up much space on a desk either. Inside it has an Intel Pentium or Celeron processor.



Acer's modular PC is incredibly flexible, allowing you to add more components simply by stacking them one on top of the other

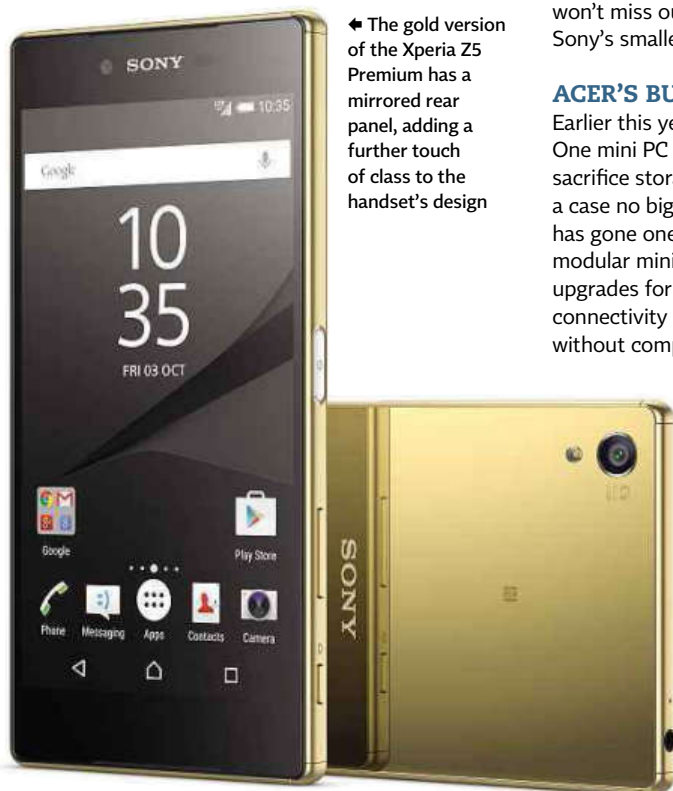
The base unit is equipped with HDMI, DisplayPort, Ethernet and two USB3 ports, as well as 32GB of storage, but two of the first modular upgrades will be external HDDs. A slightly more off-the-wall inclusion is the wireless charging dock, which sits on top of any Revo Build stack and adds a wireless charging pad for giving compatible phones a power boost when their battery is low. You can detach the base and take it with you too, as it has its own internal battery.

There's no word on prices for the upgrade modules, but the base unit is set to arrive across Europe this month, with prices from €199 (around £146) depending on hardware.

LENOVO MIXES IT UP

It may look eerily reminiscent of Microsoft's Surface Pro 3, but Lenovo's new IdeaPad Miix 700 is a decidedly more budget-orientated two-in-one tablet device. With US prices starting at \$699 (around £460 excluding VAT), the Miix 700 will be available in a range of specifications, including one of Intel's new Skylake-based Core M processors, up to 8GB of RAM and up to 256GB of SSD storage.

While it's unlikely to match Microsoft's Surface Pro 3 for raw processing power, the Miix 700 more than makes up for this with its



◆ The gold version of the Xperia Z5 Premium has a mirrored rear panel, adding a further touch of class to the handset's design

➔ From the outside, the Miix 700 looks almost identical to Microsoft's Surface Pro 3



large 12.1in, 2,160x1,440-resolution display, and its height-adjustable kickstand should allow plenty of flexibility when you want to switch between laptop and tablet mode. We don't yet know if Lenovo will charge extra for the detachable keyboard, but like Microsoft's Touch Cover keyboards, it has a magnetic strip across the top that snaps on to the bottom of the tablet to provide a raised typing angle.

As for connections, the Miix 700 has two full-size USB ports – one of which doubles as the power supply – a Mini HDMI output and a microSD card slot. A 4G version will also be available, and some models will include Intel's depth-sensing RealSense 3D cameras as well.

SAMSUNG GEARS UP

There were plenty of wearables on show this year too, but top honours go to Samsung's Gear S2. This is Samsung's first circular smartwatch, but unlike its previous watches, you don't need a Samsung phone to use it. Samsung says it will be compatible with almost any Android device that has 1.5GB or more of RAM and runs version 4.4 or above. It still needs to be running certain Android APIs, which may rule out older devices, but Samsung has yet to provide a complete list of compatible handsets.



The Gear S2's stainless steel bezel houses a 1.2in Super AMOLED display, which you can use to answer calls and track your fitness

Still, it's a huge improvement over previous Gear watches, and it comes with a full range of sensors, including an accelerometer, gyroscope, barometer, heart rate monitor and an ambient light sensor. You can also answer or dismiss calls from your wrist, and those who pair it with a Samsung smartphone can take advantage of the Samsung Pay contactless payment system.

As well as two buttons on the side of the watch for stepping back through menus and returning to the home screen, the Gear S2 has a rotating bezel for controlling the interface. Turning this one notch to the left displays notifications, while rotating to the right flips through your widgets, including weather, music controls, calendar appointments, activity statistics and any third-party apps you've installed. Samsung's S-Health activity tracker, Twitter and Nike+ Running are just some of the apps confirmed so far, and car manufacturers including VW and BMW are on board with plans to use the Gear S2's NFC capabilities in forthcoming vehicles.

With a 250mAh battery, the Gear S2 should provide between two and three days of general use, according to Samsung, but with 10 brightness levels available, it could potentially last much longer. When it does



➤ Instead of LED lights, Philips has installed tiny pico projectors on the back of its Ambilux models to extend its light show even further

eventually run out of power, you can charge it with the supplied wireless charging dock.

Samsung has yet to announce pricing for the Gear S2, but it will begin shipping this month. The launch will be staggered, and the UK isn't guaranteed to be first on the list, but the device should be available here soon.

PHILIPS LIGHTS THE WAY

IFA is typically a very TV-heavy technology show, and Philips went all out this year, showing off its incredible new 65PUS8901 4K Ambilux model. Ambilux is the next step up from the existing Ambilight ambient backlighting technology Philips has been using in its TVs for years, only this time the LEDs have been swapped for tiny projectors that expand what's onscreen out to the wall

behind it. It works brilliantly in games and with sports, and you feel as if the action is exploding out of the screen and into the room.

More importantly, Philips hasn't had to make the panel any thicker – the 65PUS8901 is still less than a centimetre thick. The polished chrome 'Bladewire' stand puts two sculpted feet at the sides to keep the set upright, but you can wall-mount the TV and still enjoy the full effect of the projectors.

The Ambilux TV is due to arrive in the UK and throughout Europe towards the end of the year. Philips hadn't yet released any prices, but they're likely to be towards the top end of Philips' price structure.

THE RESULTS SPEAK FOR THEMSELVES

Apple launches iPhone 6s, iPad

APPLE ANNOUNCED A whole range of new products at its recent press conference in San Francisco. As well as two updated iPhones, Apple also unveiled its long-rumoured iPad Pro, its biggest iPad to date, and a new version of the Apple TV media streamer.

BITE OF THE BIG APPLE

Available around the world from November, the iPad Pro has a massive 12.9in, 2,742x2,048 resolution display. This is large enough to fit two iPad Airs inside it when the device is lying in landscape mode, effectively giving you enough space to run two full-screen iPad Air apps side-by-side without forcing them to run at a reduced scale in iOS 9.

That's a lot of screen to play with, but the iPad Pro's main party trick comes in the form of its variable refresh rate. By monitoring what's onscreen, it can tell when your screen is static and will automatically halve the refresh rate to 30Hz, helping to save energy. It will then raise it back up to 60Hz when it detects video, for example.

Inside, a 64-bit A9X processor has twice the memory bandwidth of the A8X used in the iPad Air 2. It also has twice the graphics performance, thanks in part to Apple's new Metal programming language. There will be two storage options at launch (32GB and 128GB), and both should deliver around twice the storage performance as the iPad Air 2. Essentially, it's more than fast enough to run two iOS apps at once, or render a single powerful 3D app with more detail or more polygons than any other iOS device to date.

There's also room for a four-speaker system. With a driver at each corner, the iPad Pro can automatically balance the audio depending on how you hold it. The left, right, top and bottom channels will adjust to sound in both portrait and landscape modes.

Despite the performance improvements and bigger screen, the iPad Pro should still be able to deliver 10 hours of continuous use on a single charge. You also get 802.11ac Wi-Fi, and an 8-megapixel iSight camera on the back of the tablet – the same sensor as the one seen in the iPhone 6 and iPhone 6 Plus.



If you're a budding artist or professional graphics designer, the Apple Pencil could be a must-have accessory for the iPad Pro

PENCIL PUSHER

To make the most of the Pro's screen, Apple is releasing a number of optional accessories to go with it, including the Apple Pencil. Despite Steve Jobs' famous dismissal of the technology, this digital stylus can be used for drawing and note-taking. It charges via a Lightning connector on the end of the pen, and should last up to 12 hours on a single charge. When you're out of power, you can plug the Pencil into the iPad Pro's Lightning port to draw extra juice from your tablet.

Apple also announced a physical keyboard for the iPad Pro to turn it into a fully mobile workstation. Dubbed the Smart Keyboard, this uses the same shallow dome switches as the latest 12in MacBook, giving plenty of tactile feedback while still enabling you to type quickly. It also shares power and data with the iPad Pro using a new magnetic Smart Connector. It's a similar setup to the Magsafe power connector on the MacBook, meaning you don't need to unplug anything or worry about wrenching cables apart if you disconnect the tablet in a hurry.

UK pricing has yet to be announced for the iPad Pro and its various accessories, but there will be three models available at launch: an entry-level 32GB, Wi-Fi-only model for US\$799; a 128GB Wi-Fi-only model for \$949; and a 128GB Wi-Fi and 4G cellular model for \$1,079. The Apple Pencil will cost \$99, while the Smart Keyboard will cost \$169.

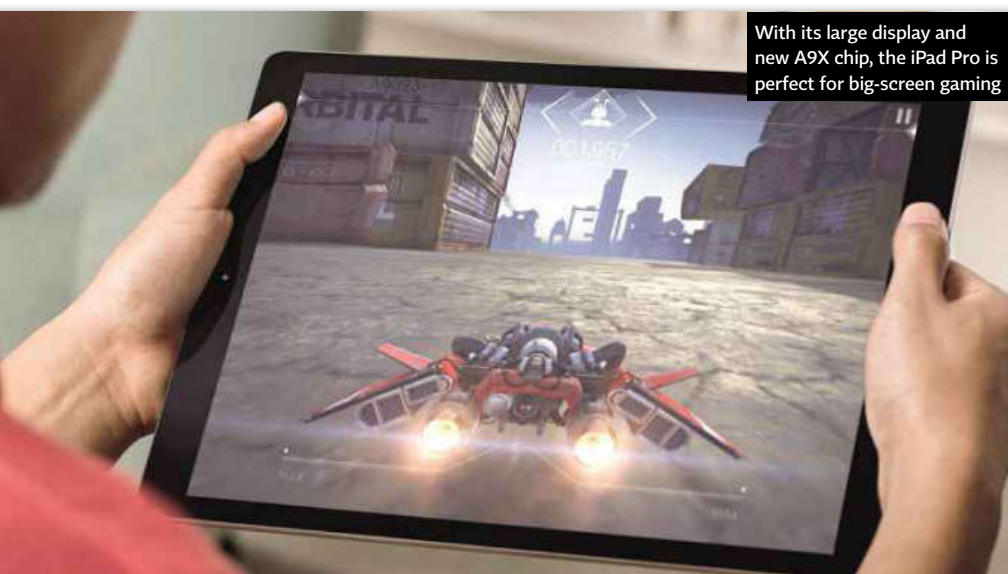
SIRI-AL KILLER

Apple's next big announcement came in the form of a new Apple TV. The current model was released way back in 2012, so an update has been long overdue. The box itself is almost exactly the same size as the previous model, but inside it's all new, as it comes with Apple's brand-new operating system, tvOS.

The interface looks very familiar to the existing Apple TV UI, but it's a little brighter and a little cleaner. Navigation is handled by a new remote control, which has a touchpad rather than a control dial like an old iPod. This should make it easier to fast-forward and rewind through films and TV shows with a simple left or right swipe. The remote uses Bluetooth 4.0 and has an integrated battery that lasts around three months. Cleverly, it's charged via its Lightning port on the bottom.

The 2015 Apple TV also has Siri integration, so you can launch apps and control playback using the remote's microphone. You can even use natural phrases such as, "Siri, I missed that", and it will automatically jump back 15 seconds and turn on subtitles when you're watching a film.

To find your chosen content, Siri will search across multiple apps, including iTunes, Netflix, Hulu, HBO and Showtime (although the latter three are only available in the US). However, Apple has said it will be integrating more services in the future.



With its large display and new A9X chip, the iPad Pro is perfect for big-screen gaming

Pro and Apple TV

Finally, the 2015 Apple TV has its own app store. Previously, Apple TV had only a handful of locked-down services that came pre-installed, but now you can download all sorts of apps, such as Airbnb and various games. It's not yet clear whether catch-up TV services and rival media-streaming apps will follow, but we have every hope the Apple TV app store will be better stocked than the Android-based Nexus Player or the popular Roku 3.

As for hardware specs, the 2015 Apple TV is powered by a 64-bit A8 chip and has an HDMI 1.4 output for Full HD (1,920x1,080) playback. It also has Bluetooth 4.0 support, 802.11ac Wi-Fi and a Fast Ethernet port on the back for anyone who wants a wired connection. UK pricing wasn't available at the time of going to press, but in the US it will cost \$149 for the 32GB version and \$199 for the 64GB model when it arrives.

TOUCH AND GO

Last but certainly not least, Apple also announced a new pair of iPhones: the iPhone 6s and iPhone 6s Plus. According to Apple, these are the most advanced iPhones yet, and add a wave of new features, including 3D Touch and Live Photos.

From the outside, both phones look almost identical to their predecessors. The iPhone 6s still has a 4.7in 1,334x750 display, and the iPhone 6s Plus continues to loom over its little brother with its massive 5.5in 1,920x1,080 screen. They are, however, a fraction fatter than before, with the iPhone 6s measuring 7.1mm thick and the iPhone 6s Plus stretching to 7.3mm.

This is likely to go unnoticed in daily use, but the reason behind this increase in size is so that each phone's screen will be able to accommodate Apple's newest, and arguably most exciting feature: 3D Touch, a mobile version of Apple's Force Touch technology that we've seen in the Apple Watch, the new MacBook and MacBook Pro.

With more sensors packed inside the touchscreen, the iPhone 6s can measure the microscopic changes between the cover glass and the backlight, providing faster, more accurate responses to each press. 3D Touch also allows you to interact with your apps in new ways. For instance, apply pressure to an app icon on the homescreen and it will open a popup window of options, letting you perform tasks faster without opening the app itself. For instance, rather than open the camera app



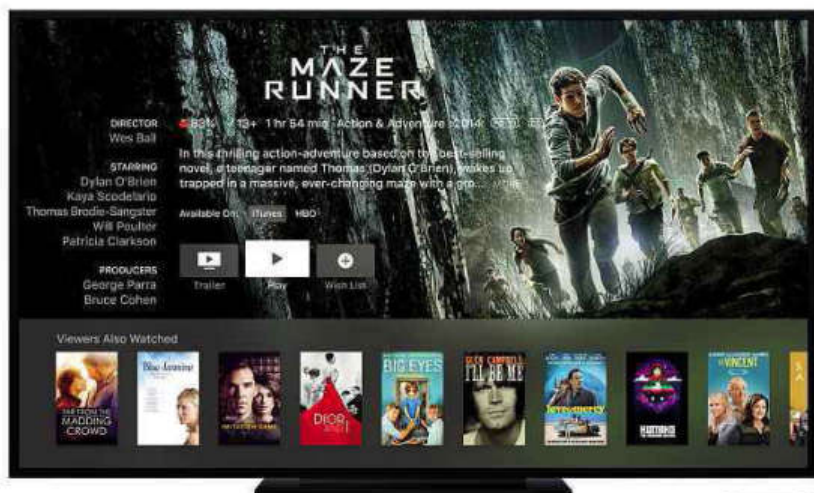
▲ In addition to the standard, gold, silver and space grey models, the iPhone 6s and 6s Plus will also be available in rose gold

to take a video, 3D Touch allows you to jump straight to video mode from the homescreen.

The iPhone 6s and 6s Plus also have a brand-new processor: the A9. This has an all-new transistor architecture to make it faster and more energy efficient. The M9 motion co-processor is also embedded right into the A9 chip to provide always-on Siri.

Another new addition is a 12-megapixel iSight camera. This lets you capture both HD and 4K video content, as well as 63-megapixel panorama shots. 3D Touch will work with your camera, too, creating Live Photos. These are essentially short videos that capture the moments before and after each shot, allowing you to create moving images, which you can then share with your friends.

The only mildly disappointing thing about the new iPhones is that they will still come in 16GB, 64GB and 128GB models, dashing any hopes we had of an entry-level 32GB version. Still, at least Apple hasn't increased the price of each phone, as both will retail for the same prices as the current iPhone 6 and iPhone 6 Plus. For the iPhone 6s, that's £539 for the 16GB model, £619 for the 64GB model and £699 for the 128GB model. For the iPhone 6s Plus, it's £619 for the 16GB version, £699 for the 64GB version and £789 for the 128GB version. Both phones are available now, and we'll bring you a full review next month.



▲ The 2015 Apple TV has an updated interface, new hardware and a brand-new remote control

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Three launches 4G Super-Voice to eliminate indoor black spots

THREE HAS LAUNCHED its new 4G Super-Voice service. Powered by Voice-over-LTE (VoLTE) technology, Three's 4G Super-Voice service should dramatically improve indoor and rural coverage across the Three network.

Based on a new 800MHz spectrum, which will run alongside Three's existing 3G 2,100MHz and 4G 1,800MHz spectrums, 4G Super-Voice allows signals to travel much further than before, helping it penetrate those dreaded 4G black spots inside your home and in remote rural areas. This should mean customers will finally be able to make calls, send texts and get online in places where they previously had very poor signal.

It will also finally allow customers to make calls over 4G. At the moment, Three's 4G network only runs data services, so if you make a call, you fall back to its 3G network. However, 4G Super-Voice will enable 4G voice services, enhancing the quality of calls while speeding up connection rates and setup times.



Three said 4G Super-Voice already covers 50% of the UK population for indoor coverage, as well as three-quarters of London, Edinburgh, Exeter and Birmingham. The service will roll out in other cities

across the country, including Cardiff, Manchester, Liverpool and Bristol, and Three expects that more than 1 million customers will be able to use it by the end of the year.

There is a catch, though, as you need a compatible phone. Right now, only the Samsung Galaxy S5 and LG G4 support the service, a Three spokesperson told *Shopper*. Three expects that most current handsets will support the service before the end of the year, including the iPhone 6 and 6s, the Samsung Galaxy S6, S6 Edge, HTC One M9, the Microsoft Lumia 640 and Nokia Lumia 735. Handsets older than two years are unlikely to support the service.

To use Three's 4G Super-Voice service, customers must be running the latest OS software update. When the update is ready for a particular handset, they'll receive an alert and update instructions.

Canon reveals sensor with 250 megapixels

CANON HAS DEVELOPED a digital camera sensor containing 250 million pixels, giving rise to the prospect of a massive bump in DSLR resolutions. The APS-H sensor – which is a halfway house between the APS-C sensors found in consumer cameras and the full-frame units found in professional gear – captures 19,580x12,600 images: roughly 30 times as many pixels as you'll find on a 4K television.

Canon claims the images are so detailed that, in a test photo, viewers were able to make out the lettering on the side of a plane flying 11 miles above the ground. Canon didn't reveal which lens it used for the shot, but that the lettering was visible when it used software to zoom into an area approximately $\frac{1}{40,000}$ th the size of the image.

The resolution is greater than even professional photographers and video makers could cope with at present, although Canon claims the real advantage of capturing footage in such detail is that you can crop into small parts of the frame without any noticeable drop in clarity.

Storing its output is a bigger problem. Shooting footage at 30fps at Full HD resolution on the Canon 70D consumes around 10MB of storage per second. The 250-megapixel sensor has 125 times the resolution of Full HD, which would equate to roughly 1.25GB of storage per second of footage at the same frame rate. However, Canon admits its new sensor currently shoots at only five

frames per second, due to the sheer amount of data it's processing.

There's little hope of the sensor finding its way into DSLRs in the foreseeable future. Instead, Canon says it is "considering the application of this technology in specialised surveillance and crime prevention tools, ultra-high-resolution measuring instruments and other industrial equipment".

✦ Canon's new sensor produces massive images, but it's unlikely ever to make its way into a consumer DSLR



BBC delays Micro Bit launch until 2016

EARLIER THIS YEAR, the BBC announced ambitious plans to give every Year 7 pupil in the country a free Micro Bit computer (see *News, Shopper* 332). This small Raspberry Pi-like device was originally intended to arrive in October, but the BBC has since announced that its Micro Bit rollout will be delayed until 2016 because of manufacturing issues. The purpose of the cheap, low-powered board is to introduce children to coding, but a problem with its power supply means they will now have to wait until "after Christmas" to get their barebones computer.

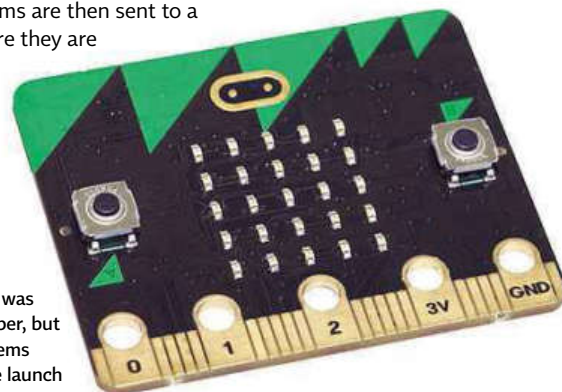
A BBC spokesperson said the problem had "affected a small number of devices", but that it was still "expecting to start sending them out to teachers before Christmas and to children early in the New Year."

"As a result of our rigorous testing, we've decided to make some minor revisions to the device – getting it right for children and teachers before we manufacture one million units is our priority," the BBC said.

Powered by a 32-bit ARM Cortex M0 CPU, the BBC Micro Bit is a 40x50mm board that contains a matrix of 25 red LEDs, two programmable buttons, a motion detector and a magnetometer (or digital compass), as well as Bluetooth and five I/O pins for connecting other devices and sensors. However, it doesn't include a display output or any expandable storage.

Instead, the BBC will launch dedicated software for the Micro Bit, which will enable children to program the device using a computer, tablet or mobile phone. The software will support Microsoft's Touch Develop language, JavaScript, Python, C++ and Blocks. Programs are then sent to a central server where they are compiled for the Micro Bit, before being downloaded and flashed to the device over Bluetooth.

✦ The BBC Micro Bit was due to arrive in October, but manufacturing problems have now pushed the launch back until after Christmas



Amazon unveils new family of Fire devices

AMAZON ANNOUNCED A number of new devices in September, including three tablets, an Ultra HD Fire TV box and a brand-new Fire TV Stick with a voice-activated remote control.

The tablets, which start at just £50, will run Amazon's new Fire OS 5 Bellini operating system. Amazon's Fire OS has always been based on Android, but Bellini is the most Android-like operating system yet, as Amazon has ditched its old carousel design in favour of a more standard grid-based home screen. Content is still divided into separate tabs, such as Books, Games, Apps and Video, but it should make each device much easier to use than previous Fire tablets.

The new OS will also take full advantage of Amazon Prime Instant Video's On Deck feature, which lets you download shows to watch offline. Programmes download in the background to any spare storage space you have, making sure you've always got something to watch.

The new tablets come in a range of sizes. The £50 Fire is the cheapest and smallest, with a 7in IPS display, while the Fire HD comes with an 8in or 10.1in screen and costs £130 or £170 respectively.

Amazon hasn't announced the resolution of the Fire yet, but both Fire HD tablets will have only 1,280x800 resolution displays. That's just about acceptable on an 8in device, with a pixel density of 189 pixels per inch, but may start to appear pixelated on a 10.1in display.

Still, Amazon claims its tablets will be more durable than the current iPad Air 2, surviving twice as many tumbles in its own lab tests. Each will



↑ You'll need an Amazon Prime subscription to get the most out of the new Fire TV and Fire TV Stick, but it's not absolutely necessary



◆ The Fire HD will be available in multiple colours, with a brand-new interface that's based heavily on Android Lollipop

also have a microSD card that supports cards up to 128GB, offering plenty of storage, with battery life topping out at seven hours for the Fire and eight hours for both Fire HD tablets. The tablets come in a variety of colours, with protective cases costing £20 more, and are available to buy now. We'll bring you a full review next month.

Amazon also revealed new models of its popular Fire TV and Fire TV Stick streaming devices. Available now for £80, the 2015 Fire TV has a 4K UHD output, enabling users to take full advantage of today's newer 4K TVs. With more 4K content arriving on Amazon's own Instant Video service and Netflix, there should be plenty of films and TV shows available to get you started.

However, Amazon hasn't yet confirmed whether the Fire TV's YouTube app will also support 4K. When asked about future 4K support on the YouTube app, Amazon told *Computer Shopper* it has "been in conversation with YouTube and they're excited to bring their 4K content to our platform," so it sounds as if it's on the way.

The new Fire TV will also support High Efficient Video Coding, so it should deliver better quality 1080p content too – Amazon says it's up to twice as efficient as H.264. The box will also come with 8GB of internal storage and can be expanded up to 128GB with a microSD card.

Meanwhile, Amazon's updated Fire TV Stick includes a new remote control, which now supports voice search. This will allow users to find content simply by speaking the name of an actor, film or director, adding another layer of convenience when you're trying to find something to watch. The new Fire TV Stick will be available from 22nd October and will cost £45.

3.5x

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GREY IMPORTS



It can often be cheaper to buy tech products from sellers based overseas, but that discount might be down to tax avoidance

THESE DAYS, THE best price for a gadget can be only a click away. Google even helps by listing promoted suppliers at the top of your search results – but when some retailers offer goods for 30% to 40% less than others, is the deal too good to be true? Not necessarily. Welcome to the complex area of grey imports.

Grey importing is when products are sold outside normal sales channels. The sale itself is legal, but the goods are often shipped from outside the final market, raising issues of tax, duties, warranties and returns. The practice also enables you to buy products that have never been launched in this country, such as the Nokia N1 tablet (see page 28).

So how can you spot a grey importer? The presence of a UK phone number on a website is no guarantee that the firm is based here. Many such sites operate from Hong Kong, and if you buy from one of these, your usual consumer rights won't apply, so check customer reviews before buying.

A good source of ratings is Trustpilot, which is like TripAdvisor for retailers. Most of the reviews you'll find on this site are glowing. If a site isn't mentioned on Trustpilot or found in Google-sponsored results, it might be a scam – you can verify this by searching for the name plus "review" or "problem".

COMMON COMPLAINTS

Unfortunately, not all resellers provide a good service. Many buyers of camera kit report receiving lenses or bodies that have been split from kits and then repackaged, for example,

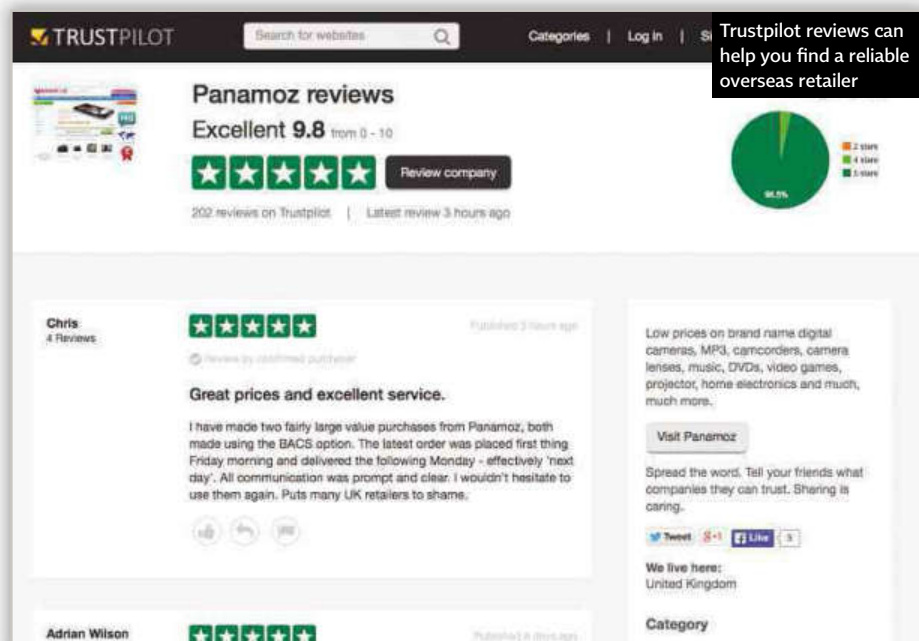


The presence of a UK phone number on a website is no guarantee that the firm is based here

reducing their second-hand value. There have been reports of inaccurate photos and orders, while 'in stock' can be an elastic term. A wait of five or six days is usual, but there are stories of items not showing up for a month. SLRHut's customers noted that the firm phoned them before processing their online order, and while some appreciated the personal touch, others objected to being offered alternative products.

Don't expect to receive stock from the UK – goods may come from China, Russia or anywhere outside Europe. Whether this matters depends on the manufacturer. According to several users, Olympus, for example, will honour an international warranty based on any valid receipt, while lens-maker Sigma is opposed to grey imports. Apple reportedly doesn't care where a product was bought, but make sure you watch out for technical differences, such as PAL versus NTSC or different power-supply requirements.

Since you're not buying your goods within the EU, you don't get a two-year guarantee as standard either. Grey importers usually offer their own warranty bought in from an international provider. If you need to claim against it, you'll have to send your product to a third-party workshop.



Buying goods on the international wholesale market and offering them direct to UK customers isn't illegal (although it may involve a breach of contract somewhere), but in today's global market, it's not obvious why that should make them cheaper. Retailers such as Cam2 and Tin Cheung advertise the same prices online as in their Hong Kong shops, and you'll rarely find them for less than the pre-VAT price in the UK. Yet much lower prices are advertised for UK imports.

PAYING VAT

Presumably, UK suppliers know where to go for the best wholesale deals, so might grey imports involve an element of tax evasion? When goods are shipped from outside the EU to a personal customer, a tax bill is sent – usually through the courier firm – to the supplier (if they've agreed to pay it) or to the

Some grey suppliers promise a refund if you receive a tax bill. That's highly suggestive that there might be some attempted misdeclaration, although it could occur due to error. Others just state that you won't have to pay any tax but don't explain why. Simply Electronics is unusual in disclaiming responsibility for tax and duty, correctly warning that the customer may have to pay it.

We phoned several grey-importing companies for details. Twice we reached automated messages. A third supplier, based in England but under a name listed by Companies House as "dormant", answered. After four attempts to track down an elusive manager, we gave up. Finally, at Expedite Electronics, a woman with a professional telephone manner answered our questions. Did the prices include VAT? No, because "the main company" was based in Hong Kong. Did

A known method of VAT evasion is to mark packages with a value below the £15 threshold rather than the real price

customer. A known method of VAT evasion is to mark packages with a value below the £15 threshold rather than the real price paid.

We're not suggesting that any of the companies named here are involved in this practice, but plenty of customer stories are doing the rounds. One affirmed that his supplier had failed to "do an accurate customs declaration, to dodge the VAT. My camera was declared as a low-value toy accessory." The gamble doesn't always pay off: "I've since ordered a camera from another Hong Kong firm, which was delivered after being held by customs for seven weeks. I've paid the VAT and hope to be refunded [by the supplier]."

The Home Office's Border Force is responsible for customs enforcement. A spokesperson told us that the agency aims to "disrupt any fraud that cheats UK taxpayers and undercuts honest businesses", and that it carries out checks to "assess whether the values on customs declarations are credible". Border Force will also "respond to any specific intelligence about the suspected undervaluation of goods".

that mean we might get a VAT bill? No: "You don't have to pay any VAT and the import duty and tax is already included."

If companies bring goods from outside the EU into UK warehouses and sell them on, they're responsible for the VAT, not the customer. If the goods are shipped directly to you from abroad, however, you're probably liable to pay the VAT on receipt. One problem is that there's no easy way for a consumer to check that the tax has been paid.

GREY ADVICE

If you're thinking of buying grey, go in with your eyes open. First, do the research. We found many items for hundreds of pounds less than UK prices, but a few were cheaper in the UK. Read the terms and conditions, which are often on a page called FAQ or Shipping. These range from explicit – requiring you to return faulty goods within a limited period, for example – to the unnerving, such as when 'shipping insurance' is an extra cost.

Make sure you pay by credit card, because then the card issuer is jointly liable for

Other ways to buy abroad

Grey imports are not the same as personal imports. Many foreign retailers offer delivery to the UK, leaving you to pay the VAT and duty. Reputable New York company B&H (www.bhphotovideo.com), for example, usefully shows a calculation of shipping, tax and duty while you're browsing an item. Foreign eBay sales usually work in a similar way, but misdeclaration is not unknown.

A few UK-based firms, such as HDEW Cameras, sell grey imports. With low prices backed by the reassurance of English law, this could offer the best of both worlds, although some users have said the company could be clearer about what you're getting, including kit splits.

One legal way to avoid some of the tax is to bring products with you when travelling to the UK from outside the EU. If the goods are worth more than £390 in total, you must go through the red channel and pay VAT and duty on the rest of the value.

purchases of more than £100, no matter where it's from. Some debit cards offer voluntary protection too. You can request a chargeback against any card if goods aren't delivered, but you'll be relying on the cooperation of the merchant's bank, so don't hold your breath for a quick resolution.

If things go wrong with a purchase, badger the retailer until it has been put right. Insist on a replacement or refund, not a repair – if goods arrive faulty, cite breach of contract, a concept understood by courts everywhere. If necessary, log in to Trustpilot and post a complaint: many of these companies monitor reviews and they may reply. At worst you're warning others of the pitfalls. **CS**



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VERDICT

It can't match the value of its predecessor, but is still a fantastic phone thanks to its great camera and battery life

THE 2ND GEN Moto G was the best budget smartphone we'd ever seen, until the incredible Vodafone Smart Ultra 6 staged a surprise coup last month. This means the 3rd Gen Moto G finally has some competition, but with a refined design, superb build quality and a huge number of features on offer, it has a real chance to win back its crown.

That said, it's less of a bargain than its predecessors once were. The cheapest model, which has 8GB of storage and 1GB of RAM, starts at £159. Choosing your own colours with Motorola's Moto Maker service adds £20, and buying the slightly more powerful version, with 16GB of storage and 2GB RAM, costs another £30 on top of that. A microSD card slot means the extra storage isn't crucial, but the extra RAM will make a difference to speed and multitasking.

ANGLE POISE

The new handset shares design elements with Motorola's Moto X, with a metal-effect frame that curves almost seamlessly into the removable back plate, creating lovely smooth contours. The edges taper to a pleasing 6.1mm, and the 155g handset feels very strong and durable. We much prefer it to the flat, angular edges of the Sony Xperia M4 Aqua. The machined, textured finish on the power button is a particularly nice touch, making it easier to find next to the matt volume rocker.

The removable rear panels come in various colours, and you can swap them as you please, making the Moto G more customisable than other handsets at this price. The subtle



ribbed texture on each panel gives it a high-quality feel and provides plenty of grip.

When the back is properly clipped into place, the Moto G becomes IPX7 waterproof, meaning it can be dunked in up to a metre of water for 30 minutes without being damaged. It's not entirely watertight, though, so if you get it wet, you'll need to take off the back and give it a quick wipe. We found a few droplets still lingering inside during our tests.

Motorola has also managed to squeeze an extra 80mAh into the new phone's battery. With screen brightness set to 170cd/m², it provided an impressive 11h 12m of continuous video playback – over 90 minutes longer than the 2nd generation handset. It also beats every other phone in its price bracket except Samsung's Galaxy A3, which lasted 14h 30m thanks to an energy-efficient AMOLED panel.

The 2nd and 3rd Gen Moto Gs appear to use the same 5in, 1,280x720-resolution display panel, which we feel strikes the right balance between screen size and pixel clarity. Our

colour calibration tests bore very similar results, with the new handset displaying 85.4% of the sRGB colour gamut. We preferred it to the older phone's screen, which looked very warm and pink by comparison.

Black levels were reasonably dark at 0.36cd/m² on maximum brightness, and a contrast ratio of 1,061:1 provided plenty of detail. Viewing angles were excellent, but its peak brightness of 339.38cd/m² means you'll struggle to see images and dark video scenes when using the phone outdoors.

SPEED BOOST

Qualcomm's Snapdragon 410 chipset appears in many budget smartphones, but here it runs at 1.4GHz rather than the usual 1.2GHz, giving the phone a small speed boost. We tested it with both 1GB and 2GB of RAM, and both models proved significantly faster in our benchmarks than the competition. Both scored around 530 in the Geekbench 3 single-core test and 1,600 in the multicore test, whereas the 1.2GHz Snapdragon 410-powered 2nd Gen Moto E managed only 470 and 1,397 respectively.



p32 | Wired2Fire Diablo Elite



p38 | Fujifilm X-T10



p50 | Veho Muvi K2 NPNG



p53 | Nest Cam



p62 | Metal Gear Solid V

Both models were equally fast at web browsing, too, and their impressive score of 781 in Futuremark's Peacekeeper web browsing test is one of the faster scores we've seen from this chipset. Web pages loaded quickly and there were only a few signs of visible stutter on multimedia-heavy sites.

However, the real difference between the 1GB and 2GB Moto G is its ability to multitask, as apps and games loaded much faster on the 2GB version – often only by a second, but the extra RAM does make a surprising difference. That said, there are plenty of other handsets available for around £200 that use the octa-core Snapdragon 615 chipset, such as the EE Harrier and Sony Xperia M4 Aqua, which are faster still, making the 2GB Moto G seem sluggish by comparison.

A processor with a faster clock speed doesn't necessarily equal smoother graphics performance, as the score of 105 frames in the GFX Bench offscreen Manhattan test indicates. The Moto G can handle 2D games perfectly well, though, and when playing Blizzard's more demanding Hearthstone we didn't see any warnings that the phone didn't meet the recommended specifications, as we have with other Snapdragon 410 phones.

LIVING COLOUR

The 13-megapixel camera sensor is a big step up from the second generation handset's 8-megapixel sensor. According to Motorola, it's the same sensor used in the Nexus 6, which costs more than twice as much. It also has a dual LED flash, which is supposed to adjust colour temperature

The Moto G can be dunked in up to a metre of water for 30 minutes without being damaged

to make flash-lit shots look more natural, and a 5-megapixel front-facing camera.

We were a little disappointed by the flash's performance in our indoor photo tests, as it made our still-life arrangement look rather green. This was particularly noticeable on the teddy bear's fur, and the blocks of watercolour paint were also less vivid than in our non-flash shots. Admittedly, it eliminated a lot of noise, but colour quality suffered.

Plenty of detail was visible, though, and outdoor shots in particular looked superb. Colours were rich and vibrant, even in areas of shadow. HDR was a little strong at times, but it helped preserve finer details and made clouds look particularly dramatic. Shooting is fast, too, with a simple interface that's easy to navigate. A quick swipe in from the left reveals the camera's settings, while a swipe from the right opens the Gallery.

SKIN DEEP

Like Motorola's other handsets, the latest Moto G runs pure Android – in this case the latest 5.1.1 update. With no skins to worry about, Motorola can push out updates much sooner than other manufacturers. There are still a few Motorola-specific apps and

features, though. You can set the phone to enter silent mode automatically when you're at home or in a meeting, or turn off the screen and all notifications while

you're asleep, allowing only favourite contacts through or anyone who calls twice in five minutes. It also takes Android Lollipop's lockscreen notifications further, displaying the time and up to three interactive notification buttons when the screen is turned off. This is good for the battery life and incredibly handy if all you want to do is check the time.

With a higher base price and additional £209 version, the new Moto G isn't the budget bargain its predecessors were. However, we feel its exquisite design and improved features are enough to counterbalance the slightly disappointing choice of chipset, and even the faster Vodafone Smart Ultra 6 and Sony Xperia M4 Aqua can't beat its amazing battery life or stunning rear camera. Likewise, the Moto G's 5in display makes for a much more manageable handset than the 5½in screen of the Vodafone Smart Ultra 6.

The 8GB version is a better buy on contract, as you can get 1GB of data, 300 minutes and 5,000 texts for £15.50 per month with no up-front cost from Carphone Warehouse. Equivalent deals for the Sony Xperia M4 Aqua and Samsung Galaxy A3 cost £20 or more per month. Three also has some good deals on Pay As You Go, with prices starting at £140 for the 8GB version and Moto Maker models available on contract. While the increase in RAM is nice, it's not essential, especially when it costs so much more. The 3rd Gen Moto G might not be the best-value budget smartphone any more, but it's one of Motorola's best.

Katharine Byrne



SPECIFICATIONS

PROCESSOR Quad-core 1.4GHz Qualcomm Snapdragon 410 • **SCREEN SIZE** 5in • **SCREEN RESOLUTION** 1,280x720 • **REAR CAMERA** 13 megapixels • **STORAGE (FREE)** 8GB (4GB) / 16GB (12GB) • **WIRELESS DATA** 3G, 4G • **SIZE** 142x72x6.1mm • **WEIGHT** 155g • **OPERATING SYSTEM** Android 5.1.1 • **WARRANTY** One year RTB • **DETAILS** www.motorola.co.uk • **PART CODE** XT1541

Battery life

11h 12m

0% -50 Reference +50 +100

See page 72 for performance details

CURVED-SCREEN PHABLET

SAMSUNG Galaxy S6 Edge+



£600 inc VAT • From www.carphonewarehouse.com

VERDICT

In the absence of the Note 5, the S6 Edge+ is the best Android phablet around, but at current prices it's just not good value

WITH THE GALAXY Note 5 currently missing in action in the UK, those after a big-screen Samsung phone now have only one handset to turn to: the Galaxy S6 Edge+. As the name suggests, it's essentially a larger version of Samsung's existing curvy flagship, the Galaxy S6 Edge, adding a sizeable 5.7in display that towers over the smaller phone's 5.1in screen.

Big-screen phones don't suit everyone, of course, but the double-edged curves do make the Edge+ one of the more manageable phablets. It's smaller than the iPhone 6 Plus, despite having a larger display. It's more comfortable than the Galaxy Note 4, too, as its slender, narrower frame provides more purchase. The glass back is a touch slippery, but there's no denying that the S6 Edge+ is a stylish handset. It uses the same premium materials as the S6 Edge, and demands attention when you take it out of a pocket.

As desirable as the S6 Edge+ is, though, there's very little to set it apart from the rest of the S6 family. It even shares the same

The 5.7in, 2,560x1,440 display is excellent, with the Super AMOLED panel displaying full 100% sRGB colour gamut coverage. Contrast also returned a ratio of infinity:1, as peak black levels are a perfect 0.00cd/m². Admittedly a peak brightness of 388.7cd/m² isn't huge, and AMOLED panels are traditionally much dimmer than their LCD counterparts, but this figure shoots up to around 600cd/m² when you're outside to help combat screen glare.

Thankfully, the larger screen doesn't impact the phone's battery life, as it managed a respectable 13h 23m in our continuous video playback test. While this is almost two hours less than the standard S6 Edge, it's only 10 minutes behind the regular S6, so you should still get more than a full day's use out of it even if you're a heavy media user.

The S6 Edge+ continues Samsung's streak of best-in-class performance, too. The octa-core Exynos 7420 processor comprises two quad-core chips, one running at 2.1GHz

Its huge score of 1,549 in Futuremark's Peacekeeper test is the highest we've seen, beating both the S6 and S6 Edge

2,560x1,440 resolution as the smaller phone. With the same number of pixels stretched over a larger screen, pixel density is actually a fraction lower, at 515ppi compared to the S6's 576ppi. However, this is still very sharp, and you'll be hard pressed to notice the difference.

As a result, the S6 Edge+ is essentially a carbon copy of the S6 Edge, making the 0.5in bigger screen its main distinguishing feature. The large display provides more room when browsing or using two apps simultaneously in Samsung's Multi-Screen mode.

for more intensive tasks while the other runs at 1.5GHz to save on power when the phone is idle. The S6 Edge+ also has the benefit of 4GB of RAM over the S6 and S6 Edge's 3GB, giving it an extra boost while web browsing.

Its huge score of 1,549 in Futuremark's Peacekeeper test is the highest we've seen, beating both the S6 and S6 Edge by a clear 300 points. Naturally, surfing the web is as smooth as could be, with no signs of stutter or jerky animations whatsoever. The extra 1GB of RAM made less difference in Geekbench 3, though, as its respective scores of 1,463 and 4,934 in the single- and multicore tests are more or less identical to those of the S6 Edge.

The S6 Edge+ also didn't fare any better in GFXBench GL's offscreen Manhattan test, with 1,514 frames (roughly 24fps) putting it just behind the smaller Edge's score of 1,537 (or 25fps). In real terms, though, the S6 Edge+ is still a highly competent gaming machine.

The S6 Edge+ uses the same 16-megapixel sensor as the S6 and S6 Edge. It can produce clear, bright-looking photos even in overcast weather conditions, and it banishes the gloom to make sure your



photos still look great even when the sun's not shining. Our test shots all had plenty of detail, and Samsung's excellent noise reduction effectively eliminates all traces of noise and grainy artefacts. Low-light performance is equally brilliant. Noise was practically non-existent, and colours remained rich and vibrant throughout. The flash can be a little harsh at times, though, as the warm colours in our non-flash shots all but disappeared when we switched it on.

With top-class performance and a superb camera, the Galaxy S6 Edge+ rightly deserves its title as the best Android phablet since the Note 4. However, it is undeniably expensive for what essentially amounts to a relatively middling set of minor software tweaks and some serious style points. It simply doesn't do enough to make it stand out from the rest of the S6 family, so while it may be the best Android phablet you can buy today, at its current price it simply isn't good value.

Katharine Byrne

SPECIFICATIONS

PROCESSOR Quad-core 2.1GHz + quad-core 1.5GHz Samsung Exynos 7420 • **SCREEN SIZE** 5.7in • **SCREEN RESOLUTION** 2,560x1,440 • **REAR CAMERA** 16 megapixels • **STORAGE (FREE)** 32GB (25GB) • **WIRELESS DATA** 3G, 4G • **DIMENSIONS** 154x75x6.9mm • **WEIGHT** 153g • **OPERATING SYSTEM** Android 5.1.1 • **WARRANTY** One year RTB • **DETAILS** www.samsung.com/uk • **PART CODE** SM-G928F



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★★★★★

Nov 2015

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ANDROID TABLET

NOKIA N1

COMPUTER SHOPPER ★★★★★

RECOMMENDED £210 inc VAT •

From www.ebay.co.uk

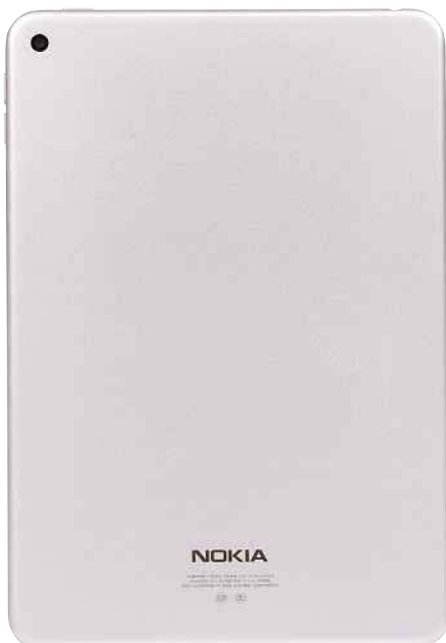
VERDICT

Hard to buy in the UK, but the Nokia N1 is a great tablet and the Z Launcher UI is brilliant

THE NOKIA N1 tablet has been selling like hot cakes in China and Taiwan, selling out in just four minutes when it was launched in January. It seems odd, then, that Nokia has yet to bring the N1 to the UK. Still, for those willing to take the risk of buying one through eBay or a grey import seller, Nokia's gorgeous full metal slate is an absolutely incredible Android tablet, and a serious threat to Apple's iPad Mini 3.

From the outside, you'd be hard pushed to tell the N1 apart from Apple's tiny tablet. Both have a 7.9in, 2,048x1,536 resolution display housed inside a sturdy aluminium chassis and they share the same 4:3 aspect ratio. Even the volume and power buttons look identical. The N1 tips the scales at 318g, making it a fraction lighter than the iPad Mini 3, and it's also slimmer at 6.9mm as opposed to 7.5mm. The N1 doesn't have the iPad Mini 3's chamfered edges, opting instead for smoother, rounder corners that sit more comfortably in the hand.

The Nokia N1 is no mere iPad Mini clone, though, as its Nokia Z Launcher gives Android 5.0.2 a real breath of fresh air. Instead of traditional home screens, the Z Launcher displays a grid of your 12 most-used apps on a single home page. Start scribbling a letter onscreen with your finger and the N1 displays everything that matches it, including apps, contacts, bookmarks and suggested web searches. The tablet will gradually learn which



apps you like to use at different times of the day and promotes them to the main home screen so you don't have to search for them.

The N1's excellent 7.9in display stands head and shoulders above its Apple rival. With a colour accuracy score of 88.8%, the N1 covers a much larger area of the sRGB colour gamut than the iPad Mini 3, resulting in more balanced, natural-looking images. The N1 was a little weak on reds and magentas, but colours still looked bright and vibrant, and we preferred it to the iPad Mini 3's display.

QUITE A CONTRAST

The N1 isn't any sharper than the iPad Mini 3, as both tablets share the same 324ppi pixel density, so text and images all look crisp and well defined. However, the N1's higher contrast ratio of 1,425:1 is almost twice as high as the iPad Mini 3. Images not only look punchier, they also have a much more convincing sense of depth, helped in no small part by deep black levels of just 0.25cd/m². The N1 leads on brightness, too, with a peak white level of 413.18cd/m², making it much easier to see in bright lighting conditions.

The N1 uses a quad-core 2.3GHz Intel Atom Z3580 processor and 2GB of RAM. Atom processors have become the default chipset for mid-range Android tablets in recent months, but the Z3580 is a cut above the rest. While not as fast as the Google Nexus 9's Nvidia Tegra K1-64 chip, the N1's Geekbench 3 scores of 917 and 2,813 in the single- and multicore tests put it comfortably ahead of other Atom-based 8in tablets such as the Tesco Hudl 2 and Acer Iconia One 8. The iPad Mini 3 scored higher in the single-core test with 1,385, but its multicore score of 2,485 shows the N1 to be the more competent multitasker. Web-browsing performance felt just as snappy, even though its Peacekeeper score of 1,165 isn't that much higher than the Hudl 2 or Iconia One 8. Scrolling complex web pages is smooth and stutter non-existent.

The N1 is a competent games tablet, too. While the high resolution makes for a pretty low onscreen score of 592 (roughly 9.6fps) in GFXBench GL's Manhattan test, it fared much

better in the offscreen test, which renders at 1080p. Here, the N1 produced a respectable 779 frames (around 13fps), just behind the iPad Mini 3's 830 frames. That may not sound very fast but, in practice, demanding games such as Blizzard's Hearthstone ran beautifully. Film and game fans will need to keep storage in mind, however, as only 24GB of the 32GB onboard storage is available to the user. There's no microSD card slot either, but 32GB should still be enough for most people.

ENDURANCE TEST

The N1's appeal doesn't stop there, as its huge 5,300mAh battery gives it plenty of stamina to get you through the day. It lasted for a fantastic 10h 47m in our video playback test, beating the iPad Mini 3 by about 90 minutes.

The main problem with the Nokia N1 is its availability. Our review sample was provided by Colourful Tech, a company set up specifically to import the N1 to the UK, but it's since had to cease trading due to ongoing disputes with Nokia. As a result, the main way to buy one is eBay, which currently has plenty of tablets on sale from reputable sellers for around £210.

This is a shame, as the Nokia N1 is a stunning Android tablet that deserves a place in UK shops. While it's not as good value as the Nexus 9, which has fallen to £200, the N1 is still an incredible tablet with exceptional build quality, battery life and a novel yet easy-to-use interface. Only its quasi-legal status prevents it being a Best Buy.

Katharine Byrne

SPECIFICATIONS

PROCESSOR Quad-core 2.3GHz Intel Atom Z3580 • **SCREEN SIZE** 7.9in • **SCREEN RESOLUTION** 2,048x1,536 • **REAR CAMERA** 8 megapixels • **STORAGE (FREE)** 32GB (24.3GB) • **WIRELESS DATA** None • **DIMENSIONS** 139x201x6.9mm • **WEIGHT** 318g • **OPERATING SYSTEM** Android 5.0.2 (Nokia Z Launcher) • **WARRANTY** One year RTB • **DETAILS** n1.nokia.com/en • **PART CODE** N1



See page 72 for performance details

PREMIUM ANDROID TABLET

SAMSUNG Galaxy Tab S2 9.7

COMPUTER
SHOPPER
RECOMMENDED

★★★★★

£365 inc VAT • From www.expansys.com

VERDICT

It has some stiff competition from Google's Nexus 9, but the Galaxy Tab S2 is the most desirable Android tablet there is for under £500

SAMSUNG HAS FINALLY decided to meet the iPad Air 2 head on with its new flagship tablet. While the Galaxy Tab S 10.5 had a larger 10.5in widescreen display, setting it apart from Apple's device, the Tab S2 has the same size, shape and resolution display as the iPad: 9.7in, 2,048x1,536 pixels and a 4:3 aspect ratio.

You could say imitation is the sincerest form of flattery, and while we've long been fans of 4:3 screens they tend to divide opinion; 16:9 and 16:10 displays have the edge for watching films, but tablets with squarer 4:3 panels tend to feel more natural in the hand in portrait mode when reading or surfing the web.

Samsung has at least engaged in some one-upmanship with its big rival. The Tab S2 is both thinner and significantly lighter than the iPad Air 2, at 389g and 5.6mm compared to 437g and 6.1mm. It's also slightly thinner than Sony's svelte Xperia Z4 Tablet.

As Sony's flagship tablet, you might consider the Xperia Z4 Tablet to be the Galaxy Tab S2's natural rival on the Android front, but as the Z4 is considerably more expensive (and comes with a keyboard) it sits in a class of its own. The Google Nexus 9 is a better fit; it also has a 4:3 2,048x1,536 screen, but a slightly smaller 8.9in display. It usually costs roughly £100 less, too, although it sometimes drops to the £200 mark at certain retailers.

LIGHT FANTASTIC

The Tab S2 makes an excellent first impression. Its light weight makes it a pleasure to hold when reading, with the Nexus 9 feeling fat and heavy in comparison. The iPad Air 2 feels like it has the edge for build quality at first, thanks to a stiffer-feeling rear, but artefacts appear on the screen if you apply even a small amount of flex.

All three tablets have impressive screens, but which you prefer really comes down to personal taste. The Tab S2 uses AMOLED technology and, like all displays of this type, has excellent contrast; it can display absolute blacks, our tests showing it as having an infinity:1 contrast ratio. In our colour tests, which we perform with a USB colour calibrator, the Tab S2 displayed 100% of the sRGB colour gamut, too. However, we had some reservations when comparing it side by

side with the iPad Air 2 and Nexus 9. Test images on the Samsung screen leapt out thanks to their vibrant colours, but look a little closer and you can see a yellow tint; a common complaint among AMOLED screens. The iPad Air 2 and Nexus 9 have no such cast, so while their images had less punch, colours seem more realistic. Turning off the Tab S2's Active Display just made images look lifeless.

The Samsung Exynos Octa 5433 processor consists of four 1.9GHz cores for demanding tasks and four 1.3GHz cores to save battery when running programs that don't require so much grunt. Our benchmarks showed it to be a strong rather than spectacular performer. In the Peacekeeper browser-based benchmark, the Tab S2 scored 1,012, well below the Nexus 9 (2,020) and iPad Air 2 (2,749). Its single-core Geekbench score of 1,230 is also far behind the Nexus 9's 1,637 and the iPad Air 2's 1,811. The Samsung tablet pulls things back in the multicore Geekbench test, with 4,194 compared to 4,516 for the iPad Air 2 and just

Android 5 runs beautifully smoothly, with none of the lag we've seen from Samsung tablets in the past

2,818 for the Nexus 9. The supplementary low-powered cores appeared to help in our video playback battery test, where the tablet scored an impressive 12h 9m; over two-and-a-half hours more than the iPad Air 2, but slightly less than the Nexus 9 could manage.

Subjectively, however, the tablet certainly doesn't have any performance problems. Android 5 runs beautifully smoothly, with none of the lag we've seen from Samsung tablets in the past. Certain websites, such as the *Guardian*, even seemed slightly smoother on the Tab S2 than on the Nexus 9.

The operating system has some neat touches, notably Samsung's own multitasking system. If you press the Recent key, certain apps have an extra icon at the top-right. Pressing this will make the app snap to a portion of the screen. You can then resize the amount of room the app takes up on the screen. This means you can look at email at the same time as a map, for example.



Gaming is one area where the Tab S2 can't match up to the competition. In the GFXBench Manhattan test it scored just 956 at its native resolution, which is far off the Nexus 9's 1,942 and the iPad Air 2's 2,331. Popular fantasy card game Hearthstone was perfectly playable on the Tab S2, but there was some occasional jerkiness; not something we experienced on Google or Apple's tablets.

The Galaxy Tab S2 is an impressive tablet.

It's slim, light and has a generally excellent screen, as long as you're willing to put up with a slight yellow tint for the sake of excellent contrast. However, it sits in an odd position in the tablet market. It's £100 less than the 32GB iPad Air 2, which has superior performance, if worse battery life, and is up to £165 more than the price-yoyoing Google Nexus 9, which isn't as nice an object but has stronger performance. However, if you can't stretch to Sony's £500 Xperia Z4 Tablet and want a high-end Android tablet, the Tab S2 is a great buy. It wins a Recommended award.

Chris Finnamore

SPECIFICATIONS

PROCESSOR Octa-core 1.9GHz + 1.3GHz Samsung Exynos Octa 5433 • **SCREEN SIZE** 9.7in • **SCREEN RESOLUTION** 2,048x1,536 • **CAMERA** 8 megapixels • **STORAGE (FREE)** 32GB (23GB) • **WIRELESS DATA** 4G + £90 • **DIMENSIONS** 169x237x5.6mm • **WEIGHT** 389g • **OPERATING SYSTEM** Android 5.0.2 • **WARRANTY** One year RTB • **DETAILS** www.samsung.com/uk • **PART CODE** SM-T810



Psst. Here's how to costs while upping

There are easy steps you can take to reduce
wastage and create better-looking results

18%

WorkForce Pro
models are up to
18% quieter than rival
laser printers and
copiers



There's an easy way for businesses around the country to dramatically reduce waste and energy consumption. To improve the quality of your printouts. What's more, there's a way to take advantage without spending a penny more: most businesses can actually shave money off their monthly costs sheet.

The evidence comes from a new set of independent tests by Buyers Laboratory LLC (BLI) commissioned by Epson. BLI tested several WorkForce Pro models against a selection of competing colour lasers and laser copiers and found that Epson's printers produce up to 95% less waste when printing up to 80,000 pages.

Why? "Laser printers and copiers use a combination of heat and pressure to fuse toner to the paper," explained Paul Steels, Director of Business Image, Epson Europe. "Instead of heat, Epson's inkjet printers use

subtle changes in pressure to fire ink droplets on to the paper, so they consume minimal energy when printing."

At the same time, European businesses could save up to 4.5 days in labour costs per year by switching from laser to inkjet technology. This is based on more independent tests by BLI.

The research found that Epson's WorkForce Pro inkjets are up to three and a half times faster than laser and colour copiers for the first page out. And that they're up to

twice as fast as competitor's inkjets for first page out.

What's more, by switching to Epson's RIPS technology (see opposite), businesses can cut time spent on user interventions by up to 100%

**"We don't take account
of the lost time people
spend waiting for the
first page to appear"**

compared to colour lasers and copiers on a run of 40,000 prints.

All of this research shouldn't be a shock.

Everyone who works in an office has surely experienced the aggravation of waiting for a short document to emerge from the printer, or needing to replace toner before your page will emerge.

It's easy to think that the simplest answer is to pop down to the nearest PC retailer and invest in new printers. Perhaps shop on

Amazon for the one with the highest star rating. But this isn't always the best approach for most businesses.

Instead, you should at the very least investigate managed print services. At a stroke, it means experts in printer efficiency can assess your printer setup and suggest the best way to

95%

Epson's WorkForce
Pro printers produce
95% less consumable
waste when printing
up to 80,000
pages



Find out more by calling **01442 227220**
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EPSON
EXCEED YOUR VISION

100 minutes

Picking a WorkForce Pro can save up to 100 minutes of worker time on interventions

control costs. It could be drastic – slashing the numbers of printers, perhaps cutting out the personal printers senior executives demand.

There are obvious advantages from an IT perspective. New consumables will arrive when you need them, with no need to build up a stockpile. You'll have predictable costs that you can budget for with confidence. And if something goes wrong with the printer, you don't have to rush to a nearby shop to replace it.

“New consumables will arrive when you need them, with no need to build up a stockpile”

But it should also increase the quality of the printouts you produce, reduce wastage and result in happier staff. This is partially because new printers

are so much better suited to a busy office environment than the ones likely to be sitting unloved in the corner. For example, BLI found that WorkForce Pro models are up to 18% faster than competitive laser printers and copiers.

Many modern printers also include features you might only expect to see in large enterprises. One easy way to cut out all those forgotten prints – where people send them to the printer and

then forget to pick them up – is to use a PIN so that the job only starts when they enter it. This is also an effective way to ensure sensitive documents don't sit on the printer, which happens in every office in the land.

The final upgrade is to image quality. Why put up with grainy images when you can benefit from pin-sharp photographs? Why hand out a pitch document with blotchy graphics that undermine your message when you can add to the power of your arguments with a few standout images?

The message is clear. If you've been guilty of ignoring the printers in your office, or replacing them on a piecemeal basis, it's time to take control of the situation. After all, wouldn't you do that if you could genuinely see the time and money being wasted?

75,000

The number of pages a WorkForce Pro can print using RIPS technology



What is RIPS and why you should care

IT staff and employees waste hours fiddling with printer cartridges and waiting around whilst the printer is out of commission. If you buy a WorkForce Pro with Replaceable Ink Pack System (RIPS) technology – available exclusively via a managed print contract – then the problem virtually disappears. The black cartridges last for up to 75,000 pages, while the colour inks keep pounding out the pages up to 50,000 times. The result? A huge number of benefits...

Stop wasting time

Reduce downtime spent managing and disposing of supplies, walking to central printers, waiting for prints or locating lost or stolen documents. Distribute printers in the most sensible places so your employees can enjoy local, high-quality printing.

Stop wasting money

Lower the cost of all that wasted time and energy, put IT resources to better use and streamline your supplies management with Epson's RIPS technology. Achieve predictable print costs while reaping the productivity benefits of the distributed print model.

Stop wasting resources

Four ink supply units, or a mountain of toners, photoconductors, drums and packaging? No contest. Plus, WorkForce Pro RIPS significantly lowers the environmental burden of logistics and recycling to help you meet your environmental targets.

WIRED2FIRE Diablo Elite

COMPUTER
SHOPPER
RECOMMENDED£1,539 inc VAT • From www.wired2fire.co.uk

VERDICT

The Diablo Elite more than justifies its bulk and expense with incredible performance and ample storage and expansion options

THE HUGE WIRED2FIRE Diablo Elite and the tiny Chillblast Fusion Nano Fury (opposite) demonstrate how wildly different nearly identically priced gaming PCs can be.

The Diablo Elite comes in a large, plain Fractal Define S case. It's an ATX chassis with an unconventional design that means it can be slightly difficult to work with when you're upgrading components. The case is designed with efficient cooling in mind, with a rather industrial-looking top panel with a huge grille on top. The front panel design means there's no room for an optical drive or any other external 5¼in drive bays, so you'll need a USB drive if you're dependent on optical discs. The intake vents on the front are used by a single 140mm intake fan, while there's a second 140mm fan at the rear. With just the graphics card between the front and rear of the case, there's little to obstruct airflow.

COOLER SHAKER

The top panel mounting point is occupied by a Fractal Design Kelvin S36 closed-loop water cooler. It's generally quiet, although it does sometimes kick in unnecessarily when you're undertaking light tasks such as copying files and opening simple apps. This is normally only a brief increase in noise, but it's noticeable because the top panel isn't insulated.

The water-cooling system is present to keep the overclocked Intel Core i7-6700K at a reasonable temperature. This quad-core 'Skylake'-generation chip normally runs at a maximum Turbo Boost clock speed of 4.2GHz, but Wired2Fire has used the processor's

unlocked multipliers to increase this to 4.7GHz. As you may have already guessed, it's a bit of a monster. Paired with 16GB of 2400MHz DDR4 memory, the PC powered its way to an incredible score of 182 in our 4K benchmarks, the highest score we've ever recorded in these strenuous tests.

The score breaks down to 158 in the image-editing test, 176 for video-encoding and 195 for the multitasking test. There's nothing this PC can't handle, and that's before we get to its graphics capabilities. The Nvidia GeForce GTX 980 Ti sits between the absurd GeForce Titan X and the more wallet-friendly GTX 980. It has 6GB of GDDR5 graphics memory with a maximum throughput of 336GB/s, which is seriously fast. The card alone costs around £590, so makes up more than a third of the Diablo Ultra's overall price. There's no doubting the card's power, but it will be overkill unless your monitor has a resolution of at least 2,560x1,440, or preferably higher.

15 MINUTES OF FRAME

At 1,920x1,080, the GeForce 980 Ti is far more powerful than even today's most graphically intensive games require at maximum settings. At this resolution the PC completed our Dirt Showdown and Metro: Last Light tests with scores of 160fps and 63fps respectively. The card is challenged only when you crank things up to 3,840x2,160. At this resolution we saw 70fps in Dirt Showdown and 38fps in Metro:

Last Light (once we'd disabled super-sampled anti-aliasing), which is hugely impressive.

To help the case's airflow-friendly design, storage drives are shunted into the tight space behind the motherboard and are only accessible via the right-side panel. There's room for three 3½in or 2½in drives and space for a further two 2½in drives behind the motherboard.

Wired2Fire has installed a 500GB Samsung 850 Evo SSD, which leaves you plenty of room for your games and programs. A 2TB Seagate hard disk is also included. If you want more storage, there are enough SATA3 connectors for



four more drives and an M.2 socket to bolt a fast and tiny SSD directly to the motherboard.

The Asus Z170 Pro Gaming motherboard has plenty of other room for expansion: you can install another graphics card, for example, as both Nvidia SLI and AMD CrossFireX are supported, and still have another PCI-E x16 slot free (running at x4 speed). There are also three further PCI-E x1 connectors for smaller peripherals such as Wi-Fi adaptors.

At the rear of the board are two USB3.1 ports, one of which is a Type-C reversible connector. In addition, there are four USB3 connectors at the rear and two more at the front of the case. There are also two USB2 connectors at the rear, along with five 3.5mm audio jacks and an optical S/PDIF port. The graphics card, meanwhile, has a DVI connector, three DisplayPort connectors and an HDMI port.

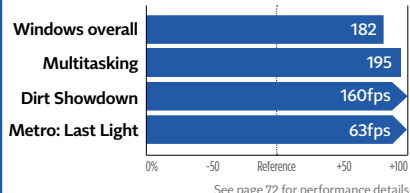
The Wired2Fire Diablo Elite is a very large but powerful PC. It may not have the charm of the compact Chillblast Fusion Nano Fury, but in terms of raw power it's unmatched by any other PC we've tested. If you have a monitor capable of stretching its graphics card, the Diablo Elite is a fantastic choice.

Michael Passingham



SPECIFICATIONS

PROCESSOR Quad-core 4GHz Intel Core i7-6700K (overclocked) • **RAM** 16GB • **FRONT USB PORTS** 2x USB3 • **REAR USB PORTS** 1x USB3.1, 1x USB Type-C, 4x USB3, 2x USB2 • **TOTAL STORAGE** 500GB SSD, 2TB hard disk • **GRAPHICS CARD** 6GB Nvidia GeForce GTX 980 Ti • **DISPLAY** None • **OPERATING SYSTEM** Windows 10 Home 64-bit • **WARRANTY** Three years RTB including two years parts cover • **DETAILS** www.wired2fire.co.uk • **PART CODE** SYS_W2F_DIABELITEREVIEW



MINI GAMING PC

CHILLBLAST Fusion Nano Fury



£1,500 inc VAT • From www.chillblast.com

VERDICT

An incredibly small and powerful gaming PC, but it's far too noisy

IF GIANT PCs such as the Wired2Fire Diablo Elite (opposite) aren't your thing, perhaps the Chillblast Fusion Nano Fury is the right PC for you. If you were to remove the graphics card from the Diablo Elite, the Fusion Nano Fury would nearly fit snugly inside its larger rival.

The PC's Raijintek Metis chassis measures just 190mm wide, 277mm deep and 254mm high and is made of brushed aluminium. The PC is also available in black, green, red, blue, grey and gold finishes. Chillblast has modified the case to make the compact design work: the firm has machined an exhaust hole in the top of the chassis that allows the AMD R9 Fury Nano graphics card, which is mounted upside down inside the case, access to a decent amount of ventilation.

The Fusion Nano Fury takes its name from this card; a tiny graphics adaptor that can match some of the most powerful full-size models. It's just 152mm long, 110mm wide and 39mm thick, but you pay for the size; the card costs £500 on its own.

THE SOUND AND THE FURY

For such a tiny component, the AMD R9 Fury Nano managed truly astonishing performance. In Dirt Showdown at 1,920x1,080 with High detail and 4x anti-aliasing, the card managed a huge 136fps, and we even saw 58fps in the demanding Metro: Last Light benchmark. This Full HD performance is in line with what a full-size Nvidia GeForce GTX 980 can achieve. Ramp things up to 3,840x2,160, and it's still a capable performer, managing 67fps in Dirt and 30fps in Metro. It's not quite as quick as the

GeForce 980 Ti inside the Wired2Fire PC, and you will have to start tweaking graphics settings on the latest games if you want to play them in Ultra HD, but it's seriously impressive for such a small card.

There's a problem, though. The card produces a significant amount of electrical coil whine in the form of a high-pitched buzzing. This is a known problem with R9 Fury Nano cards and is only audible under specific circumstances. For example, it was loudest when running Dirt Showdown and quieter in Metro: Last Light. The whine is even audible when the case is sealed. As AMD's production process gets more refined, new cards may get quieter, but it's a pretty big drawback on current cards.

WATER BOARD

The overclocked quad-core Intel Core i5-6600K processor is cooled by a Corsair Hydro H75 closed-circuit water-cooling system. Processing performance is strong, although with a maximum Turbo Boost speed of 4.4GHz, it isn't clocked as high as some of the larger Core i5-6600K-based builds we've seen. In our 4K application benchmarks the Fusion Nano Fury scored 124 overall, which is a fair way short of the 182 achieved by the 4.7GHz Core i7-6700K in the Wired2Fire PC.

Chillblast supplies 16GB of 2,400MHz DDR4 RAM, which should be enough for most applications. There's a 250GB Samsung PCI-E M.2 SSD for Windows and apps. M.2 SSDs are quick; this one has a maximum claimed read speed of 2.1GB/s and 1.2GB/s sequential write speeds, which is more than double the throughput of the Samsung Evo 850 SATA SSD in the Wired2Fire PC. It may have half the capacity, but if speed is key, there's no competition. The SSD is backed up by a 2½in 1TB Seagate hybrid hard disk, which has 8GB of solid-state storage to boost performance for the files and programs you use the most.



As you might expect, expansion is limited. In reality, the only way you could ever add components to this PC would be to remove others first. Both RAM slots on the Asus Z170I Pro Gaming motherboard are filled by 8GB 2,133MHz DDR4 memory modules, and while you could in theory expand this to two 16GB modules, this would cost you more than £200. There's a free SATA3 connector, but finding a space for another drive is impossible as there are no free mounting points. Forget adding extra kit to the motherboard, as there are no PCI-E slots beyond the single x16 slot occupied by the graphics card. The motherboard does at least come with 802.11ac Wi-Fi, so you won't need to worry about finding space for a fast wireless card.

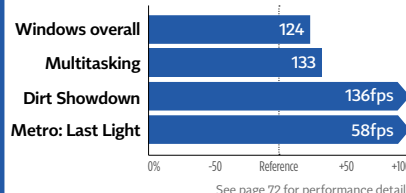
The Chillblast Fusion Nano Fury is the most powerful small-form-factor PC we've ever tested. Although you don't get the extreme power of a larger desktop PC, its graphical prowess is still very impressive. The audible coil whine from the graphics card is a drawback, however, and not something that can be easily forgiven in a £1,500 PC. It might be worth seeing if quieter R9 Fury Nano cards are produced before splashing out on a tiny gaming PC such as this.

Michael Passingham



SPECIFICATIONS

PROCESSOR Quad-core 3.5GHz Intel Core i5-6600K • **RAM** 16GB • **FRONT USB PORTS** 2x USB3 • **REAR USB PORTS** 2x USB3, 1x USB3, 2x USB2 • **TOTAL STORAGE** 250GB SSD, 1TB hybrid hard disk • **GRAPHICS CARD** 4GB AMD Radeon R9 Fury Nano • **DISPLAY** None • **OPERATING SYSTEM** Windows 10 Home 64-bit • **WARRANTY** Two years collect and return with parts cover followed by three years RTB • **DETAILS** www.chillblast.com • **PART CODE** Fusion Nano Fury



GAMING LAPTOP

ASUS ROG G751JT



£1,320 inc VAT • From www.saveonlaptops.co.uk

VERDICT

The Asus ROG G751JT is a gargantuan gaming laptop with some nice gamer-friendly touches

JUST ONE LOOK at the Republic of Gamers (ROG) G751JT is enough to tell you it's a gaming laptop. With a large 17.3in screen and decidedly non-shoulder-friendly 4.8kg bulk, it's not a laptop designed to be regularly moved around. It's heavier and thicker than most other 17in laptops, mostly because of the 8-cell battery and aluminium construction.

The soft-touch coating on the lid, keyboard surround and palm rest area are pleasant enough, but more importantly are non-slip – something that could prove important during intense gaming sessions. Asus has taken inspiration from stealth fighters in the angular design and sharp lines. The contrasting glossy metal panel in the lid holds a menacing LED Asus Republic of Gamers logo.

The keyboard has a similarly glowing red backlight that can be adjusted to different brightness levels. The all-important WASD keys have red accented highlights around the edge to make them stand out even further.

STEAM POWERED

Other design flourishes geared towards gamers include the three programmable macro keys and dedicated Steam key, which opens up Steam in Big Picture Mode, putting your games library within quick reach. There's also a one-touch video recording button for instantly capturing gaming footage. Another shortcut key takes you to Asus's Gaming Center, which provides quick access to the macro key customiser and ROG GameFirst III settings for ensuring your network conditions are optimised for gaming performance.

The keyboard itself is comfortable to type on with a decent amount of travel to the keys. The entire keyboard is angled towards you, thanks to the tapered laptop base. Gamers will also appreciate the cursor keys being clearly separated from the rest of the keyboard.

The touchpad is surprisingly comfortable to use. It's sizable, and has a generously sized

palm rest area. There are dedicated mouse buttons as well, which are preferable to software-controlled all-in-one touchpads. Multitouch gestures are supported too. Neither the keyboard nor the palm rest area become warm under use, a testament to the system's efficient cooling.

What the G751JT lacks in portability, it makes up for with sheer power. The 2.6GHz quad-core Intel Core i7-4720HQ processor will Turbo Boost up to 3.6GHz when thermal conditions allow. The dual-fan system that keeps the system cool does a great job of providing these suitable conditions, too. Thankfully even under load the fans never picked up to distracting noise levels. Desktop performance from the processor was as good as expected with an overall score of 108 in our benchmarks. You won't have any problems with day-to-day tasks or a spot of video editing in between gaming sessions.

FAIR GAME

Anyone considering the G751JT will be most interested in how it performs with games. It's equipped with an Nvidia GeForce GTX 970M processor with 3GB of GDDR5 memory, which provides plenty of grunt for today's games. Dirt Showdown saw a frame rate of 83.9fps at 1,920x1,080, 4x anti-aliasing and Ultra graphics, which is silky smooth. In Metro: Last Light Redux at 1,920x1,080, SSAA on, Very High graphics the system managed an average 30.2fps. Turn off SSAA and you'll see an impressive 54.9fps, with fewer periods where the frame rate drops to uncomfortable levels.

The G751JT does well when it comes to connections, too, with four USB3 ports and a Thunderbolt port. VGA and HDMI video outputs are available for hooking the laptop up to external displays, and you also get a DVD-RW optical drive and an SD card reader.



Asus has managed to pack in a subwoofer into the laptop's chassis, meaning more low-frequency presence. We're used to laptops sounding tinny, so this was a nice change.

The G751JT's 17.3in matt display is more respectable than outstanding, although the lack of glossy coating means distracting reflections are cut down considerably. Our colour calibrator measured black levels at 0.36cd/m², which isn't quite as deep as we'd expect for the money, and a contrast ratio of 964:1 is also a little low. An sRGB colour gamut coverage of 86.1% is also fairly average, but viewing angles are excellent.

SOCKET AND SEE

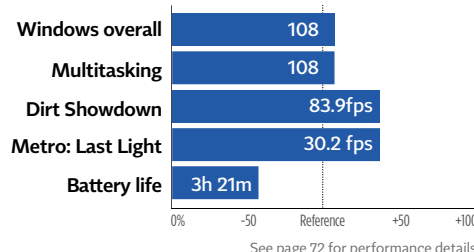
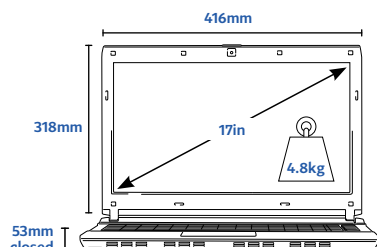
You don't expect all-day battery life from a gaming laptop, but the 3h 21m the G751JT lasted in our average-use benchmark was still a little disappointing. Attempt to play any games away from a power socket and this figure will drop considerably.

The Asus ROG G751JT is cheaper than the Gigabyte P37W v4 (see tinyurl.com/p37wv4), which has similar specifications, but it's also heavier and thicker, with poorer battery performance. The Asus has better build quality and a more comfortable keyboard and touchpad, though, so the two laptops are hard to separate. If you have the money, both are great choices depending on what qualities you value most. The Asus has a slight edge, as battery life isn't likely to be the most important consideration on a laptop this large.

Richard Easton

SPECIFICATIONS

PROCESSOR Quad-core 2.6GHz Intel Core i7-4720HQ • **RAM** 16GB • **DIMENSIONS** 416x318x53mm • **WEIGHT** 4.8kg • **SCREEN SIZE** 17in • **SCREEN RESOLUTION** 1,920x1,080 • **GRAPHICS CARD** 3GB Nvidia GeForce GTX 970M • **TOTAL STORAGE** 256GB SSD, 1TB hard disk • **OPERATING SYSTEM** Windows 8.1 • **PARTS AND LABOUR WARRANTY** One year RTB • **DETAILS** www.asus.com/uk • **PART CODE** G751JT-T7115H



MICRO PC

DELL Inspiron Micro Desktop (3050)

COMPUTER
SHOPPER
RECOMMENDED

★★★★★

£189 inc VAT • From www.dell.co.uk

VERDICT

An inexpensive PC which is powerful enough for everyday tasks

WE'VE SEEN A few sub-£200 Windows PCs, but they're generally pretty compromised. Some have Atom processors, which can barely run Windows properly, and others, such as the Intel Compute Stick and Hannspree Micro PC, are hamstrung by slow Wi-Fi and only having a single USB port.

Dell's Inspiron Micro Desktop is a different proposition. It may be bigger and around £45 more expensive than the Hannspree and Intel stick computers, but it has the advantage of being a properly usable PC.

The Micro Desktop is about the same size as an Intel NUC, which means it's slightly smaller than a stack of four CD cases. The PC has a useful selection of ports; on the rear are two USB2 ports for a keyboard and mouse, HDMI and DisplayPort video outputs and a 3.5mm headphone jack. The PC is well served for networking, too, with Gigabit Ethernet and fast 802.11ac Wi-Fi. You also get two further USB ports on the front, one of which is USB3, and an SD card reader on the side.

This all means the PC feels refreshingly uncompromised when you set it up; you can plug it permanently into a printer, for example, or plug in your camera's memory card and still have a spare port for a USB flash drive. The PC lacks VESA mounts to let you screw it to the back of your monitor, but the Micro Desktop's matt black sides and glossy top are smart enough that you won't object to looking at it on your desk. The PC comes with a USB keyboard and mouse. The mouse is fine, but the keyboard's keys are rather wobbly. It's perfectly acceptable for light use, though.

As you'd expect for the price, the Micro Desktop isn't a performance powerhouse. It has a dual-core Intel Celeron J1800 processor running at 2.41GHz, and it struggled through our benchmarks to a score of 9 overall. The onerous multitasking test, where the PC has to manipulate high-resolution images while encoding and playing back 4K video, was particularly troublesome. We also have a suite of benchmarks that we run on less powerful hardware such as this, where the 4K video is replaced with 1080p. Here the PC scored 39 overall, which is about what we'd expect to see from a low-end laptop.

We're hardly expecting much from the processor's integrated Intel HD Graphics chipset, and it struggled in our game tests. We managed to get Dirt Showdown up to a just-playable 31fps by knocking the resolution down to 800x600 and



turning detail down to Ultra Low, but the game looked decidedly retro at these settings and was still jerky in places. However, the PC could play card game favourite Hearthstone smoothly.

When we first booted into Windows 10, the Micro Desktop felt very sluggish. Checking Task Manager, we found that Dell Backup and Recovery Toaster was taking up 50% of the CPU. Once Dell Backup finally loaded it didn't work anyway, and showed the error "not enough space on recovery partition, will exit". Once we'd uninstalled all the Dell software, the PC felt much quicker.

Uninstalling the Dell-branded software also had the benefit of freeing up some much-needed storage space. Out of the box, the Micro PC has 9.7GB of space left on its 32GB SSD, but once we'd purged the Programs list, we had a more useful 17.5GB. Bear in mind that this is still a pretty minimal amount of room, which you'll eat into quickly with an Office suite and a handful of applications. You'll have to be prepared to store most of your files in the cloud, and synchronise only what you need to the Micro Desktop's disk. You could also use an SD card or an external hard disk for extra storage.

The Micro Desktop is just about quick enough for everyday use. There's only the occasional jerk when scrolling up and down web pages, but they do take a while to render; a story on the Guardian site took around eight seconds to fully load, compared to four seconds on a quad-core desktop PC. Complicated web apps such as Google Sheets are also slower on the Micro PC, but still usable. It had no problems playing back 1080p video, however.

We're impressed with the Dell Inspiron Micro Desktop. It's a well-designed, properly usable PC at a low price. It even comes with a half-decent keyboard and mouse. Rivals such as the £160 Asus Chromebox don't have the power of a proper Windows operating system, while the equivalent Intel NUC micro PC would cost around £260 once you'd added

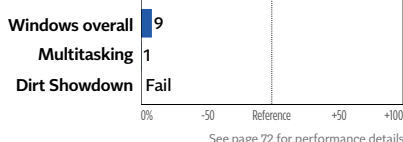
storage, RAM and Windows. For that price you could pair the Micro Desktop with a 22in Full HD monitor for a complete system, which seems like great value to us.

It's a shame it doesn't have more built-in storage and you'll have to spend some time uninstalling Dell's software to get acceptable Windows performance, but if you need a PC for simple tasks, it's a good buy.

Chris Finnamore

SPECIFICATIONS

PROCESSOR Dual-core 2.41GHz Intel Celeron CPU J1800 • **RAM** 2GB • **FRONT USB PORTS** 1x USB3, 1x USB2 • **REAR USB PORTS** 2x USB2 • **TOTAL STORAGE** 32GB • **GRAPHICS** Intel HD Graphics • **DISPLAY** None • **OPERATING SYSTEM** Windows 10 64-bit • **WARRANTY** One year RTB • **DETAILS** www.dell.com/uk • **PART CODE** D12U



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VERDICT

Luxurious and feature-packed, but the Panasonic GX8 has some stiff competition at this price

WE WERE SCEPTICAL about the Panasonic Lumix DMC-GX8. It sounded remarkably similar to the Lumix G7, albeit with a snazzier design, a higher-resolution sensor (up from 16 to 20 megapixels) and a vastly inflated price. Could these differences really be worth paying an extra £450 for?

Our scepticism quickly mellowed once we got hold of one. This is a camera that's easy to love, with a stylish design and rugged build quality that's a step up from anything we've seen from the Lumix G range before. Keen photographers will appreciate the plethora of buttons and dials, including four chunky metal rotary controllers mounted on the metal top plate. We're particularly pleased to see a dedicated exposure compensation dial, which we find more useful than the G7's drive mode dial. It's also surprisingly big and heavy. Its predecessor, the GX7, weighed in at 402g (body only), but the GX8 is 487g and around 1cm bigger in all three dimensions.

The electronic viewfinder tilts up by up to 90°; we find tilting it by about 30° gives a comfortable shooting position. As with the G7, being able to move the autofocus point using the touchscreen while composing shots on the viewfinder is nothing short of a revelation.

OPTICAL ALLUSION

The GX8 also includes in-camera optical stabilisation, something the GX7 offered but other Lumix G cameras leave for their lenses to take care of. This means that stabilisation is available regardless of whether it's built into the lens. The GX8 goes a step further when paired with a stabilised lens, using both in conjunction. We saw spectacular results when shooting at the long end of the 12-35mm lens, with consistently sharp photos at shutter speeds as slow as 1/6s. We also saw reliable results using just the in-camera stabilisation with the 20mm pancake lens at shutter speeds down to 1/13s.

The screen is articulated at the side rather than the top, which gives more flexible viewing angles. Video is shot at resolutions up to 4K (3,840x2,160), with impeccable picture quality and full control over exposure and autofocus settings. It's good news not just for videographers but for stills photographers, too, as the 4K Photo mode is essentially a 30fps continuous mode, saved as a video file. Individual frames can be extracted during playback and saved as 8-megapixel JPEGs.

There's a choice of aspect ratios, and it's even possible to capture 30 frames from before the shutter button was pressed. The only caveats are the inability to save in Raw format and that in-camera stabilisation isn't available.

Autofocus and shot-to-shot times are astonishingly fast. It delivered 8.1fps continuous shooting and kept going indefinitely for JPEGs and for 33 Raw frames. Enabling continuous autofocus, it managed an impressive 5.6fps. Subject tracking was responsive and reliable, too.

ADMIRING THE VIEWS

The star of the show is the 2.36-million dot OLED viewfinder with its massive 0.77x (equivalent) image size. That's significantly bigger than the 0.7x viewfinders used by other CSCs and SLRs at this price, matched only by the Fujifilm X-T1 (*Shopper* 316). The GX8 also has a more substantial eyecup than the GX7, which is better at cutting out light from peripheral vision. The use of OLED technology for both the viewfinder and rear screen delivers rich, contrasted colours.

The camera is splash- and dust-proof, something that proved to be extremely welcome during testing at a rain-soaked music festival. However, the choice of similarly splash-proof lenses is limited to the excellent but expensive 12-35mm and 35-100mm models, plus a few Olympus lenses.

One thing that hasn't improved is battery life, which varies between 310 and 340 shots depending on the lens and whether the screen or viewfinder is used. This is one area where CSCs trail behind SLRs. There's also a feature that has regressed: the GX8 has no integrated flash. Some CSCs come with a small detachable flash unit but it's an optional extra here.

Lumix G cameras have always put in a plucky performance in our image-quality tests. They excel for sharp details and well-judged exposure settings, but with sensors that are a little smaller than in CSCs from Sony, Fujifilm and others, they've trailed slightly behind the leaders for noise levels.

The GX8's 20-megapixel sensor marks the first time a Lumix G camera has exceeded 16

megapixels. Increased resolution can sometimes raise noise levels but we're happy to report that noise appeared to be marginally lower at ISO 3200 and above than we saw from the G7. However, it couldn't quite match the Sony a6000 (see *Reviews*, *Shopper* 319) in our studio tests, and was a fair distance behind the class leaders, the Fujifilm X-T1 and full-frame Sony a7 (both *Shopper* 316).

In our field tests the GX8 produced some superb shots, albeit with help from the pricy 12-35mm lens with its constant f/2.8 aperture. Autofocus was consistently excellent even in very low light, and photos up to ISO 6400 were good enough for critical use.

ARRAY OF LIGHT

There's a huge amount to admire about the GX8, and barely anything to criticise. The array of buttons and dials, the huge OLED viewfinder and the blistering performance make it a pleasure to use, and weather sealing is extremely welcome too. Video quality is fantastic and photo quality is extremely high, but we wonder whether people spending this much might be more tempted by the Fujifilm X-T1 or Sony a7 with their lower noise levels.

The GX8's price will inevitably come down, but with the 12-35mm f/2.8 kit currently at £1,699, it's got a long way to go before it rivals the Fujifilm X-T1 with its 18-55mm f/2.8-4 lens at £1,179. The GX8 seems like an extravagant purchase at current prices, but we can't imagine it leaving anyone disappointed.

Ben Pitt



SPECIFICATIONS

SENSOR RESOLUTION 20 megapixels • **SENSOR SIZE** 17.3x13mm (Micro Four Thirds) • **FOCAL LENGTH** MULTIPLIER 2x • **VIEWFINDER** Electronic (2,360,000 dots) • **LCD SCREEN** 3in (1,040,000 dots) • **LENS MOUNT** Micro Four Thirds • **WEIGHT** 487g • **DIMENSIONS** 79x143x63mm • **WARRANTY** One year RTB • **DETAILS** www.panasonic.com/uk



See page 72 for performance details

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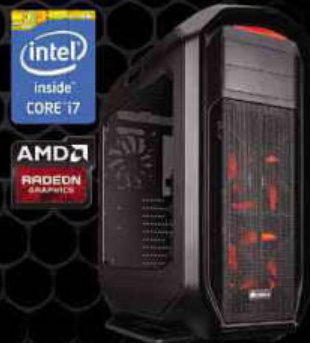
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VERDICT

With superb controls, class-leading image quality and a remarkably low price, the Fuji X-T10 is a Best Buy

FUJIFILM HAS ESTABLISHED its X Mount compact system cameras (CSCs) as a luxury brand. The retro designs and tactile controls are enough to woo keen photographers, and their superb sensors excel for low noise.

The X-T10 is the latest addition, with a name that suggests its close relation to the flagship X-T1 (see *Reviews*, *Shopper* 316). There are similarities, including an SLR-shaped magnesium alloy body, dials for drive mode, shutter speed and exposure compensation, dual command dials and a tilting LCD screen.

The £495 body-only price is half what the X-T1 cost at launch, so clearly something had to give. The X-T10 isn't weather sealed and the buttons on the back look and feel a bit cheap. It dispenses with the X-T1's dials for ISO speed and metering mode, and uses a smaller electronic viewfinder. It's just as detailed, though, with a 2.4-million-dot resolution, and its 0.62x (35mm equivalent) magnification is hardly under-specified. The 8fps quoted continuous speed matches the X-T1's but there's only enough buffer memory for eight JPEGs compared with the X-T1's 47. There's no PC sync socket for triggering flashes, but it includes USB and HDMI, a combined mic and wired remote socket plus Wi-Fi.

HANDLE MESSIAH

Using the X-T10 is a rewarding experience. The handgrip is a small ridge but the textured rubber finish and contoured thumb grip are a snug fit in the hand. The metal dials on the top plate are satisfyingly chunky and offer just the right amount of resistance. Having the dedicated shutter speed and exposure compensation dials encourages the user to think more creatively about exposure settings.

Many Fujifilm lenses have dedicated aperture rings, but for the 16-50mm kit lens,

aperture control is on the rear command dial. These controls mean there's no need for a mode dial with priority and manual exposure modes. Instead, you set the shutter speed, aperture, ISO speed or any combination as necessary.

The navigation pad on the back isn't labelled, but its four buttons and Fn key can be assigned to any of 23 options including ISO speed, autofocus area and Raw mode. Alternatively, the four-way pad can be assigned to moving the autofocus area. It's an effective and versatile system.

The menu has a few quirks, such as the way enabling face detection in the autofocus options disables metering options. It's also a little odd that the drive mode dial includes a multiple exposure option for superimposing two images, while the more useful self-timer function is tucked away in the menu.

By current CSC performance standards the X-T10 is only average. It took 1.6 seconds to switch on and shoot and 0.8 seconds between shots after enabling image reviews after capture. Continuous performance exceeded the quoted speed at 8.3fps and lasted for 11 frames before slowing to 4.2fps. Raw capture was less impressive, lasting for just seven frames before slowing to 1fps. There's no live view while shooting in continuous mode – just a display of the last shot – so it's virtually impossible to track moving subjects.

Fujifilm continues to lag behind its rivals for video too. The X-T10 records 1080p at a choice of frame rates up to 60fps, but videos are prone to aliasing problems. The exposure compensation dial works but manual exposure control is unavailable. One welcome change is that autofocus automatically reverts to continuous during recording, regardless of the position of the switch on the front of the camera.

However, it can take a long time to lock on to subjects. Overall, the video mode is perfectly adequate for the occasional clip but isn't recommended for serious video projects.

Fujifilm's attention is clearly on still image quality, and the X-T10 lived

up to the high standards we've come to expect. Colours were rich and vibrant, details were precise and highlights were expertly controlled by the automatic dynamic range processing. The star of the show was the low noise at fast ISO speeds. ISO 1600 showed barely any noise or noise-reduction artefacts, and images were good enough to print at ISO 6400. Even at ISO 12800, noise had a uniform grain rather than the splotches most cameras suffer. Other sensors offer higher resolutions but 16 megapixels is more than enough for most purposes. Along with its siblings, the X-T10 offers the best image quality we've seen this side of full-frame cameras.

TOP OF THE GLASS

Fujifilm also sent us two of its latest lenses – a 16mm f/1.4 and a 90mm f/2. These raised image quality further, demonstrating that Fujifilm's expertise isn't just in camera bodies. The choice of lens has a far bigger influence over image quality than the body, and you're much better off with an X-T10 and one of these lenses than an X-T1 and a basic kit lens.

The X-T10 isn't perfect but its weaknesses are easy to forgive for the price. The quality of Fuji's X Mount lenses add to its appeal, with 10 wide-aperture prime lenses available from 14mm to 90mm. There's no serious telephoto lens in the range, and while Fujifilm's website states this is coming soon, the disappointing Raw performance means this isn't the ideal camera for sports and wildlife photography. However, for portraits, landscapes and street photography, this is the camera to buy.

Ben Pitt

SPECIFICATIONS

SENSOR RESOLUTION 16 megapixels • **SENSOR SIZE** 23.6x15.6mm (APS-C) • **FOCAL LENGTH MULTIPLIER** 1.5x • **VIEWFINDER** Electronic (2,360,000 dots) • **LCD SCREEN** 3in (920,000 dots) • **OPTICAL ZOOM** (35mm-EQUIVALENT **FOCAL LENGTHS**) 3.1x (24-75mm) • **35mm-EQUIVALENT APERTURE** f/5.2-8.4 • **LENS MOUNT** Fujifilm X Mount • **WEIGHT** 576g (with 16-50mm lens) • **DIMENSIONS** 85x130x116mm • **WARRANTY** One year RTB • **DETAILS** www.fujifilm.eu/uk



GENERAL-PURPOSE MONITOR

IYAMA

ProLite XB2481HS-B1



£155 inc VAT • From www.box.co.uk

VERDICT

A good-value mid-range monitor perfect for multi-monitor setups, but we wish it had USB ports

WE HAVEN'T SEEN many monitors at the cheaper end of the market recently, as manufacturers have been concentrating on pushing huge-resolution 4K or high-tech gaming-orientated FreeSync and G-Sync panels. Such monitors will be overkill for many, though, so there's a lot to be said for the humble and far cheaper office monitor.

The 23.6in Iiyama's XB2481HS-B1 is such a screen, and is surprisingly attractive for the low price. Thin 12mm bezels surround the 1,920x1,080-pixel VA panel, and the whole thing looks uncluttered.

Iiyama has improved its monitor stands, with a more robust height adjustment mechanism. There's also a built-in turntable with a generous amount of tilt adjustment, and a cable-routing hole. At the rear of the monitor you'll find VGA, HDMI and DVI connectors, as well as a 3.5mm audio output for audio sent over the HDMI port. We were disappointed by the lack of any USB ports – a couple

If you're looking at an image with black in it, the monitor will produce almost no light

of ports can reduce desk clutter as well as the number of wires trailing across the desk. This is particularly annoying as we've seen cheaper 24in Iiyama screens, such as the ProLite XB2483HSU (see *Group Test, Shopper 318*) with USB ports.

Like many mid-range monitors, the XB2481HS-B1 uses a VA panel. These are typically a fantastic compromise between price and image quality, producing both deep blacks and accurate colours: two of the most important factors in image quality.

We were impressed with the images this screen produced. Our calibrator measured the screen as covering 94.3% of the sRGB colour gamut, displaying vibrant reds and greens and deep blues and purples. Contrast levels were sky high at 4,076:1, thanks to incredibly low black levels of 0.06cd/m²; to all intents and purposes, if you're looking at an image with black in it, the monitor will produce almost no light whatsoever. This helps when viewing text, which appears black and crisp, but it's also great when watching films and viewing photos. This monitor is well suited to amateur photographers who aren't



completely dependent on colour accuracy but still want to do their photos justice.

We measured its default brightness as 270cd/m², which is more than bright enough for a desktop monitor. You might even want to lower this if you'll be using this monitor for an extended period of time. Viewing angles are rated at 178° both horizontally and vertically, and while contrast starts to shift noticeably at beyond 45°, text is just about legible even at extreme angles.

The monitor's basic onscreen menus are controlled by small, unlabelled buttons on the back, and are frustrating to use. Hiding the buttons at the back stops the front of the monitor looking too busy, but failing to label them results in extended periods of bewilderment as you select options you weren't expecting and switch off the monitor at regular intervals. Even worse, the menus disappear after five seconds of inactivity, so you don't have much time to think when making adjustments.

At least there aren't too many options to play with – you get basic RGB colour adjustments, an Eco mode and various colour modes for web browsing, gaming and text editing. The standard colour mode suited us, but it's useful to have different presets that may better suit the way you use your screen.

This is about as far as you can get from a gaming monitor, but we still ran our input lag tests to see if the screen would be suitable for the occasional game. With a measured input lag of 19ms, it isn't suitable for twitchy, over-competitive gamers but should be perfectly acceptable for those who have less need of a competitive edge.

The Iiyama ProLite XB2481HS-B1 is a decent-value, attractive office monitor with great image quality. If you're looking to buy multiple screens for a multi-monitor setup, its small bezels make it an attractive option too. However, with a lack of USB ports and fiddly onscreen menus, it doesn't quite feel like the complete package. If you're just looking to buy a single monitor and don't mind thicker bezels, the Iiyama ProLite XB2483HSU has equally good image quality and USB ports, and is around the same price.

Michael Passingham

SPECIFICATIONS

SCREEN SIZE 23.6in • RESOLUTION 1,920x1,080 •
SCREEN TECHNOLOGY VA • REFRESH RATE 60Hz •
VIDEO INPUTS VGA, HDMI, DVI • WARRANTY Two years
onsite • DETAILS www.iiyama.com

CONNECTION PORTS



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PC ADVISOR

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BENQ EW2750ZL

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VERDICT

Excellent image quality for the money, but this Full HD monitor's extra features don't work as advertised

MANY MID-RANGE monitors provide great image quality, but few offer much in the way of extra features. BenQ's EW2750ZL is an exception – it's a 27in general-purpose monitor with a surprising number of image-adjustment options.

The most striking thing about the monitor is its thin construction. The screen has small bezels (8mm along the left, top and right edges) that really help to draw your eyes into the screen. The matt black finish on the bottom bezel looks better than the swathes of glossy black plastic on the base and rear, which makes the monitor look rather cheap. There's no height adjustment and no swivel – only a small amount of screen tilt to help you get your monitor into the right position.

BenQ has opted for a rather unusual port layout at the rear, with the connectors placed one above the other in a vertical line. There's no cable routing to speak of, so when the monitor is all plugged in it can look decidedly messy, with the power brick, video input and any audio cables trailing from the middle of the monitor's rear panel.

There are two HDMI inputs and a VGA connector, as well as a pair of 3.5mm audio jacks. We were disappointed by the lack of a DVI connector, but then most graphics cards and motherboards have an HDMI port, and DVI-to-HDMI adaptors are available for less than a fiver. One of the HDMI ports also supports MHL, so you can display the contents of your smartphone or tablet's screen on your monitor while charging the device at the same time.

The screen's image quality is great overall. Out of the box at default settings we could see very little wrong with the 27in VA panel. Its maximum brightness of 284cd/m² is bright

enough, and contrast levels are sky-high at 3,282:1, helped largely by the screen's ultra-low 0.08cd/m² black level. We measured its sRGB gamut colour coverage at 99.3%, so even the brightest reds, blues and greens were faithfully recreated on screen. If colour accuracy is important to you, the EW2750ZL is a decent choice. Viewing angles are a claimed 178° both horizontally and vertically, but we saw a definite drop in contrast at the edges of the screen and at any angle beyond 45°.

Bright colours, high contrast and quick response times make this an impressive all-round screen

Gamers are well served. Our Leo Bodnar input lag tester measured just 10ms of lag between sending a frame to the monitor and the panel displaying the image. That's more than quick enough for most twitchy gamers.

One of the BenQ EW2750ZL's headline features is its Super Resolution tool, which claims to enhance details for lower-resolution video and to help upscale content to Full HD. This is the sort of tech you usually see only in mid-range TVs, so we weren't particularly confident about how well it would work on a sub-£200 screen.

As soon as we switched the feature on, it was plain to see that it was simply boosting contrast, which did nothing but ruin the quality of any given video. We tested the feature with standard-definition YouTube videos and found there to be no upscaling and, more importantly, no improvement in image

quality, unless your idea of a better picture is to have extremely dark edges to sharpen up slightly soft images. This feature seems to be a rebranded 'game mode', which we often see on monitors trying to appeal to the gaming market and usually failing.

The options we found among the clunky and difficult onscreen menus include Smart Focus, which lets you highlight a small portion

of the screen and darken the rest so you can work without distractions if you don't want to minimise most of your programs. There's also Dynamic Contrast, which we found utterly confusing. All it seemed to do was boost the brightness of most images, but we didn't think this made anything look better than the monitor's default image settings.

The BenQ EW2750ZL has its drawbacks and we don't rate its image-enhancement features much, but none of these oddities takes away from the fact that this is a great monitor for less than £200. Its bright colours, high contrast and quick response times make it an impressive all-round screen. It's great value, and wins a Recommended award.

Michael Passingham

SPECIFICATIONS

SCREEN SIZE 27in • RESOLUTION 1,920x1,080 • SCREEN TECHNOLOGY VA • REFRESH RATE 60Hz • VIDEO INPUTS 2x HDMI, VGA • WARRANTY Two years onsite
DETAILS www.benq.co.uk

CONNECTION PORTS

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VERDICT

The Orbitsound A70 airSOUND has a nice, wide soundstage but its sound quality is a little disappointing for the money

SPEAKERS GENERALLY CREATE a cone-shaped area of sound where the audio quality is best. This applies to soundbars too, which means that anyone who sits to the side of the sofa won't get the best listening experience.

Orbitsound already knows a lot about trying to make sound fill as much of a room as possible. The company has taken some of the knowledge it gained from building the Spaced360 Bluetooth speaker and transferred it to the A70 airSOUND soundbar. The aim is to banish those areas outside the 'sweet spot' for home cinema audio, as well as improving on what's more than likely lacklustre sound coming out of your TV's built-in speakers.

The A70 airSOUND has five speakers: two front-facing 2in drivers and a high-definition tweeter, supported by two side-firing speakers that widen the soundstage. The A70 comes with a wireless 6½in subwoofer, too, which you can hide out of sight provided it's within reach of a power outlet.

The A70 isn't the largest soundbar out there, and while it looks attractive with a 40in television, it might look less impressive under anything larger. You can also wall-mount it with the included screws. The general design is understated, with a glossy black front that's

volume, bass and treble levels without being distracting. Where other soundbars use LED light combinations that can be difficult to decipher, this display is nice and straightforward.

Connections are somewhat limited, with just an optical and a 3.5mm input. There's no HDMI ARC, but at least you get Bluetooth with support for the less-lossy aptX codec, so you won't sacrifice sound quality when connecting a wireless device. There's NFC quick pairing as well if your device supports it.

The ability to control music playback from a Bluetooth-connected smartphone using the simple remote's dedicated media keys is a very welcome addition. The A70 supports IR

evident when watching *Interstellar*, which admittedly has difficult sound mixing, but there was little presence in *Avatar*'s action scenes too. Voice clarity was good, however, which is important if you're looking for clearer dialogue.

The A70 can reach decent volume levels, although that's no surprise when you consider the combined 300W of power between the soundbar and the subwoofer. You can make adjustments to the sound but, annoyingly, any adjustments you make to bass and treble are maintained even when you change sources. It would be better if each input had its own settings, as the audio production you want will differ depending on what you're listening to. You won't want the same settings when listening to music over Bluetooth and movie audio through the optical port, for example.

As for the A70's superior sound coverage, there was certainly less of a drop-off in quality and presence as we reached the periphery compared with traditional soundbars. This means viewers sitting to either side of the television will no longer have the worst seats in the house – at least when it comes to sound. The effect isn't massive, though, and acts more as a reduction in the diminution of sound the further you are from the centre. It does at least give the soundbar a less claustrophobic sound by widening the soundstage.

The Orbitsound A70 airSOUND is a respectable-sounding soundbar and subwoofer but it comes at a high price. For this sort of money we'd expect crisper audio and better connectivity. Samsung's HW-H750 provides superior audio production and many of the same features for slightly less, but offers greater connectivity and makes for a better choice overall.

Richard Easton

The A70 airSOUND has two front-facing 2in drivers, a high-definition tweeter and two side-firing speakers

interrupted in the centre and at each end by speaker grilles. It attracts a lot of fingerprints, so be prepared to wipe it regularly if you use the subtle touch sensitive controls. The subwoofer is an inconspicuous rectangular box, but because it's likely to be hidden away, its appearance isn't too much of a concern.

The status LEDs on the right of the soundbar dim when it's in use, letting you know which input source you're using and the

learning too, so you can teach it the IR commands from your television's remote and use it to control the TV's volume instead.

Sound quality when listening to music was respectable, with punchy bass from the subwoofer and well-represented mid-range and treble. We were a little disappointed when watching films, however, with explosions and big screen effects often sounding tinny and lacking impact. This was



SPECIFICATIONS

SPEAKERS 2 • **RMS POWER OUTPUT** 130W • **DIMENSIONS** 750x65x74mm • **WEIGHT** 2kg • **DOCK CONNECTOR** None • **NETWORKING** Bluetooth (SBC, aptX) • **WARRANTY** One year RTB • **DETAILS** www.orbitsound.com • **PART CODE** A70 airSOUND

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VERDICT

Take the time to perfect its picture settings and the Philips 55PFT6510/12 will reward you handsomely

ULTRA HD AND OLED technology might be grabbing all the headlines, but right now it's Full HD sets where you'll find the biggest bargains. The Philips 55PFT6510/12 is a 55in Full HD, Android-powered TV with a huge arsenal of features, all for just £800.

It's one of the most user-friendly TVs we've come across, with a very simple quick setup guide that gives you a few options to pick from, including basic colour saturation, contrast and audio tweaks. However, none of these choices was particularly satisfactory in the long run, pointing us towards the fine image adjustment controls found in the Advanced settings menus.

Beyond contrast and gamma settings, there are also individual colour tweaks, along with noise reduction and smooth motion controls. Out of the box, the TV displays 81% of the sRGB colour gamut, which is far from ideal – it leaves the brightest colours in colourful TV shows and films looking a little



Motion is handled exceptionally well for 24fps content, in which pans and moving objects can appear jerky. Philips' Natural Motion image interpolation creates its own frames between each video frame, making everything much smoother. The medium setting made everything look silky smooth without appearing unnatural.

With picture enhancements switched on, this is not a TV for anybody who wants to play games. Input lag was measured at a high 138ms, which makes even fairly casual gaming nearly impossible. Philips does include a game mode, however, which switches off these enhancements and drops lag to a much more palatable 38ms, which will be fine for those playing on games consoles.

The way in which you control the TV isn't consistent. Android TV handles all the smart TV functions, while Philips' own software deals with TV settings, terrestrial TV and inputs. It's a little confusing to begin with as there are several menu styles to get used to, and we had a few issues with Philips' menus not performing particularly well, freezing and stuttering as we tried to change settings.

For an £800 TV, there's a generous array of ports and connections, including four HDMI ports, three USB ports, including a USB3 connector, dual-band 802.11n Wi-Fi and an Ethernet port. There are connectors for both satellite and terrestrial TV, a 3.5mm audio jack and an optical S/PDIF port, too.

You can also use the TV as a Chromecast, streaming YouTube, iPlayer, Netflix and more from your phone, which might be preferable to using the fairly large, double-sided remote control to search and play content.

Another headline feature, though perhaps less useful to many, Ambilight mounts bright LEDs on the rear of the TV, changing colour based on what's onscreen and projecting on to your wall. It's an interesting effect, and while it's certainly nice to have and increases your TV's presence in the room, it's not a deal-clincher by any means.

The 55PFT6510/12 is good value for £800, with lots of extra features and respectable, if slightly fiddly, image quality. Android TV is a great addition and is a massive improvement over Philips' own clunky smart TV offering, although poor game performance is a bit troubling. If you want a large Full HD TV for your living room, we'd pick this over the Panasonic Viera TX-55CS520B largely because of the flexibility of Android TV.

Michael Passingham

You can use the TV as a Chromecast, streaming YouTube, iPlayer, Netflix and more from your phone

washed out. The first step was to activate ISF calibration, and with colour-calibrating hardware in hand we set about improving colour accuracy. After switching to the ISF Day pre-set and tweaking colour levels, the sRGB gamut coverage was boosted to a much more impressive 97.5%, which did bright colours a lot of favours without making things looking unnatural.

Of course, most buyers won't have a colour calibrator to hand and will stick with the presets. This is fine, but we'd urge you to spend a little time adjusting the settings while watching your favourite TV channel or movie when you first get the TV so you start off on the right foot; 20 minutes' preparation can dramatically improve your experience.

Away from colours, image quality elsewhere is good. Blacks are dark and, as a result, contrast is sky-high at 4,401:1. Even dark, space-based movies such as *Gravity* are easy to watch. The only real quality concern is backlight uniformity, which is way off: the extreme right and left edges of the TV are around 15% darker than the centre at maximum brightness. Most of the time it isn't noticeable, but with very bright colours, a dark border is just about visible.

The 55PFT6510/12 runs the Android TV operating system. When we last looked at Android TV in the form of the Nexus Player, we were impressed by the user interface but underwhelmed by a thin range of content. That was months ago, though, and things are now looking healthier, with a wide range of apps available, including BBC iPlayer, ITV Player, Wuaki.tv, Google Play Movies and Netflix.

These apps run smoothly and load quickly, although we initially had problems getting any apps to work because Philips' terms of use document failed to load, and we weren't permitted to run most of the apps until the document finally appeared on the screen.

The real boon of Android TV is that you get access to Android games and other apps – the same software you'll find on your Android smartphone and tablet – if the developer has made the app TV-compatible. We were looking forward to a quick game of *Crossy Road* but, after downloading it, we were left disappointed. Games don't run smoothly on the 55PFT6510/12 and, while Philips doesn't claim gaming prowess in its marketing material, it's still disappointing to have access to so many games that struggle with an underpowered processor.

SPECIFICATIONS

SCREEN SIZE 55in • NATIVE RESOLUTION 1,920x1,080 •
VIDEO INPUTS 4x HDMI, SCART, Component •
TUNER Freeview HD • DIMENSIONS 726x1,239x279mm •
WARRANTY Two years RTB • DETAILS www.philips.co.uk •
PART CODE 55PFT6510/12

CONNECTION PORTS





Intel i5 Elite (HAS9)

INTEL Core i5 4690K (O.C 4.6Ghz*)
ASUZ Z97-P Motherboard
Crucial Ballistix 8GB 1600Mhz
Samsung 24x DVDRW
CoolerMaster Elite 430
450W Corsair PSU
Nvidia GTX750 2GB
Windows 10 64Bit
£599.99



alphr
★★★★★

Intel i7 Elite (HAS11)

INTEL Core i5 4790K (O.C 4.6Ghz*)
ASUZ Z97-Pro Gamer Motherboard
Crucial Ballistix 16GB 1600Mhz
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£349 inc VAT • From www.debenhamsplus.com

VERDICT

Expensive, but this is the ultimate device for those who don't have room for a big TV

32in TVS CAN be bought for less than £150, so when Samsung pitches a 32in Full HD internet-connected set at £349, it's making a statement: clearly customers without much space still want all the features of a big TV.

The curved screen makes an immediate impact, with angled bezels drawing your eyes to the screen, but the rest of the TV doesn't look particularly premium. The plastic stand has a pleasing curved shape but it lacks the refined design of Samsung's higher-end models. The whole set is very chunky, too, and really doesn't feel like a high-end TV.

This is a shame, because it performs like one. Samsung has always managed to nail out-of-the-box image quality and does so here with a selection of excellent presets to suit all tastes. We found the Dynamic preset mode to be the best one-size-fits-all for brightly lit broadcast TV. It's perhaps a little bright for watching at night, so you'll want to drop the brightness a little. We found Natural a better fit for atmospheric movies with dark scenes.

There's a dedicated Sports button on the remote that boosts brightness and contrast and gives everything a bit more colour, particularly grass. It looks a bit artificial but does wonders for making moving objects stand out, and it also boosts the volume on commentary and crowd noise. It worked well on football and motor racing, but it's either on or off; it would have been nice to have a little more control over exactly what it does.

For those who like to tweak things, an Advanced Settings menu lets you make changes to blacks, flesh colour, white balance and contrast. You can also configure image-enhancement options such as colour temperature, digital noise reduction and frame interpolation. Noise reduction isn't so important on smaller TVs unless you're sitting very close, and we're not convinced the noise reduction on this TV is particularly effective. Playing around with the settings, we were never able to make SD content look much better than with noise reduction switched off. All the settings you make can be applied to just one source or to every source; we'd recommend the former as it means you can make fine adjustments without ruining your other input sources.

Out of the box, colour coverage is great at 91% of the sRGB gamut, while contrast is very high at 3,434:1. Reasonably low black levels of 0.6cd/m² mean darker scenes in games and films

are still easily viewable with plenty of detail, even if your lights are switched on. The only thing we missed was the ability to tweak individual colours to perfect the TV's performance. It's a shame, although not entirely unsurprising to see on a cheaper TV.

Viewing angles are very wide, and while we're not entirely convinced the curved screen adds a lot to its performance, we couldn't find a reasonable angle where we weren't able to watch the TV happily.

Samsung's Auto Motion Plus frame interpolation is highly configurable, with three presets and a Custom mode that lets you balance between blur or judder reduction and LED brightness. We found little need for the most configurable options; the Smooth preset was able to iron out the most obvious juddering in our Blu-ray test footage.

The Samsung UE32J6300 is expensive for a 32in TV, but if you want a great bedroom TV it's worth every penny

If you're planning on hooking up a games console to one of the four HDMI ports, you'll want to make sure Game Mode is switched on. It's hidden in a hard-to-find menu in the System area of the Settings area, and even though it's not linked to any of the picture quality settings, switching it off will only turn it off for the source you currently have selected. With Game Mode off, input lag is a disappointing 127ms, but with it switched on it drops to 48ms. This still isn't ideal and isn't the lowest lag figure we've seen, but for most games it will be fine.

The speakers are very impressive. While a proper soundbar or speaker system will eclipse it, if you're going to be using the UE32J6300 as a secondary TV, you'll be impressed with how well bass is served up, while dialogue, music and sound effects all get room to breathe. Broadcast TV sounds great, and while complex audio arrangements in films sound a little flat, audio performance is extremely creditable.

There are four HDMI ports and a set of composite and component connectors on the back of the set.



You get an optical S/PDIF port for speaker systems and there's also a 3.5mm port for wired headphones. Three USB ports are also included, and they're all on the right of the TV, so you can easily connect and disconnect peripherals such as USB sticks and keyboards. Three of the HDMI ports are on the side, too, making them easily accessible.

As we've come to expect, Samsung's smart TV interface is excellent. It comes pre-loaded with a few apps including BBC iPlayer and All 4. There's an app store full of video and radio catchup applications including Netflix,

YouTube, Amazon Instant Video and ITV Player. Plex is also available if you want to set up a DLNA server at home. The interface isn't the smoothest we've come across, though, despite the set using a quad-core processor. Slight stutter and lag is manageable, however, and it wouldn't put us off buying the TV.

The Samsung UE32J6300 is very expensive for a 32in TV, but if it's going to be your main TV – or you really want a great bedroom TV – it's worth every penny. It's easy to set up and get great image quality out of the box, while it also allows you to tweak enough of the settings to get exactly what you want out of each input source.

Michael Passingham



SPECIFICATIONS

SCREEN SIZE 32in • NATIVE RESOLUTION 1,920x1,080 •
VIDEO INPUTS 4x HDMI, Component, Composite •
TUNER Freeview HD • DIMENSIONS 428x370x91mm •
WARRANTY One year RTB • DETAILS www.samsung.com/uk • PART CODE UE32J6300AK

CONNECTION PORTS

HDMI x4 • Component • Composite

PORTABLE BLUETOOTH SPEAKER

MINISTRY OF SOUND Audio S Plus



£130 inc VAT • From www.johnlewis.com

VERDICT

The Audio S Plus is a decent-sounding Bluetooth speaker, but it's a little expensive

AFTER A LONG hiatus away from hardware, Ministry of Sound is back with a new range of speakers. The Audio S Plus is a portable Bluetooth speaker, and while it's slightly lighter than rival speakers, there's little here to set it apart from the competition. The durable, pill-shaped body has nicely rounded corners, with metallic speaker grilles that give it a reassuring weight in your hand, but there's little here we haven't seen before. The white colour scheme with gold accents at least looks the part, or there's a subtler black model with silver accents if you prefer.

It's the vertical stand that helps separate the Audio S Plus from the likes of Pure's Voca and the Cambridge Audio G2. As well as lying horizontally, the Audio S Plus can also be positioned vertically, which helps reduce the amount of space needed to squeeze the speaker on to a bedside table or bookshelf.

Beyond Bluetooth pairing, the Audio S Plus also has NFC for making a quick connection

to compatible smartphones or tablets, a 3.5mm auxiliary input for playback from a wired device, and a Micro USB port for charging. Ministry of Sound says the battery should last for around 15 hours of playback; we matched this claim in our testing, an impressive result for a speaker of this size.

The two 2in drivers and passive bass radiator inside the Audio S Plus have a combined output of 10W, which is more than adequate for filling a small- to medium-sized room with sound. It isn't quite as loud as other Bluetooth speakers in this price range, but much of the competition becomes overly harsh at high volumes.

The Audio S Plus, on the other hand, remains tight and controlled throughout. There's not an abundance of lower frequency response, but it never felt particularly lacking. Mids and trebles are similarly well presented,



but at times were slightly lacking in energy. Doubling up two Audio S Plus speakers would certainly help here; you can connect them wirelessly with Bluetooth, with one acting as a master for your phone to connect to, and run them in stereo.

You can also use the Audio S Plus for hands-free conference calls thanks to a built-in microphone. Sensitivity was perfectly adequate for talking at about a metre distance from the speaker at a natural volume.

The Audio S Plus produces reasonably clear and precise audio for a Bluetooth speaker, but it's expensive for what you're getting. At this price, less-lossy aptX Bluetooth support should really be a given. Without it, the Audio S Plus feels costly in comparison to the Best Buy award-winning Cambridge Audio G2, which has better sound production for less money, and some might argue it has a classier design, too.

Richard Easton

SPECIFICATIONS

SPEAKERS 2 • **RMS POWER OUTPUT** 10W • **DOCK CONNECTOR** None • **WIRELESS** Bluetooth (SBC, aptX) • **DIMENSIONS** 110x134x240mm • **WEIGHT** 505g • **WARRANTY** One year RTB • **DETAILS** www.ministryofsound.com • **PART CODE** Audio S Plus

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From www.johnlewis.com

VERDICT

The HDR-1100S is an attractive Freesat+ PVR that's easy to use and integrates catch-up TV seamlessly through Freetime

THE HUMAX HDR-1010S (see Reviews, Shopper 317) is a great PVR, but was starting to look a bit dated. Humax has slimmed the design down considerably for this latest model, in part by ditching the front LCD panel that was available on the HDR-1010S.

The LCD was a bit redundant on the older model, as it merely indicated constantly what channel you were watching. Removing it helps make the HDR-1100S look a whole lot less old-fashioned. Instead, a small colour-changing status indicator will tell you what the box is doing. It's far less distracting.

The new model is available in glossy white or black, with the colour choices extended to all the different storage capacity models. Previously, certain colours were only available on certain sizes, so now there's no reason to compromise on either design or storage. The HDR-1100S is available in 500GB (£190), 1TB (£220) and 2TB (£300) versions; the 500GB model we reviewed should hold around 125 hours of HD content or over 300 hours of SD content. Recording is a one-button action, or you can schedule recordings through the EPG.

Removing the largely unused SCART socket from the back of the box has also helped reduce the HDR-1100S's dimensions – it's really not something that will be missed by anyone with an HD TV. Instead, you get HDMI and composite video outputs, and optical TOSLINK for audio.

As the HDR-1100S is a Freesat+ box, you'll need to connect it to a satellite dish. There are two coaxial connections, one for each of the HDR-1100S's tuners. With both connected to your dish, you can then record one program while you watch another. The box can either be connected to an existing satellite, such as those installed by Sky, or you can choose to have one installed especially.

There are then no ongoing subscription fees and Freesat will get you access to over 200 TV and radio channels, including 11 high-definition

broadcasts. You can also connect the box to your home network, either through Ethernet or the integrated Wi-Fi – Humax has finally ditched optional dongles in favour of a built-in adaptor. Getting the box online will be important if you want to take advantage of Freetime's on-demand functions.

Freetime lets you scroll through TV listings back by up to a week for the channels provided by the terrestrial providers. The content is actually streamed through the relevant channel's catch-up service, so you'll

omission means you'll need another device to watch if you have the relevant accounts. You can at least play video, photo and music content from a flash drive using the two USB ports, and the HDR-1100S will also recognise networked PCs and NAS devices that support DLNA streaming.

The way the box lets you know when the standard-definition channel you're watching is also being broadcast in HD with a shortcut appears in the onscreen menu letting

The box lets you know when the standard-definition channel you're watching is also being broadcast in HD with a shortcut that lets you jump to the higher-quality channel

use BBC iPlayer for any BBC content, but it's all accessed from a single screen.

You can navigate through the television listings through the EPG and, using the BBC channels as an example, selecting a specific program will open up BBC iPlayer directly on the relevant content ready for playback. It's a seamless experience and at times easier than using the dedicated catch-up app, although that is also an option. All the terrestrial catch-up services are available, which is great. The only minor annoyance was the ITV Player app, which lacked the polish of the others and strangely used low-resolution icons.

There are also a few other apps available, including YouTube, BBC News and BBC Sport, but the list hasn't changed much from previous Humax boxes. On-demand services such as Netflix or Amazon Instant Video would have brought the HDR-1100S more up to date, but their

you jump right to the higher-quality channel. This is much faster than hopping into the TV Guide and scrolling through the list to find the HD channels manually.

The Freetime companion app for iOS or Android emulates the Freesat menu, only with the added benefit of a touchscreen interface. Considering the four-way navigation buttons on the included remote control are incredibly loud and clicky, this is definitely the control method we'd choose.

In the end there's not a lot to dislike about the HDR-1100S. If you're looking for a Freesat box to avoid ongoing subscription costs, it's a slick and easy to use PVR. Recording content is easy, as is managing the recordings. The interface is clean and, save for the odd hiccup, responsive and well presented. It builds on what we've liked about previous Humax Freesat PVRs with a more attractive design. The only thing now lacking is support for additional streaming services so that there can be one box that can handle all the entertainment in your AV cabinet.

Richard Easton



SPECIFICATIONS

TUNERS 2x DVB-S2 Freesat • **DIMENSIONS** 280x48x200mm
 • **NETWORKING** Gigabit Ethernet, 802.11n Wi-Fi •
INTERNAL DISK CAPACITY 500GB • **WARRANTY** One year
 RTB • **DETAILS** www.humaxdirect.co.uk •
PART CODE HDR-1100S-White



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£189 inc VAT • From www.amazon.co.uk

VERDICT

A veritable bargain of an action camera with plenty of accessories bundled in

THE K2 NPNG doesn't ship in a cardboard box – it arrived at our office in a hard carry case that you can use to transport the action camera and its accessories around with you. A clasp keeps the case locked shut, and it's generously padded inside. There's just enough room for additional accessories should you buy other mounts, too.

The hard case is just one of the extras you wouldn't expect to get with the K2 NPNG given its low price. The other highlight is an LCD screen that attaches to the back of the camera to provide a live view and additional navigation controls. It's similar to the optional Touch BacPac available for GoPro cameras, but without touchscreen controls. This means you can frame your shots easily and change settings without using your smartphone.

It comes with a decent array of mounts, including various sticky and Velcro mounts for

You'll only get about 1hr 30m of 1080p footage at 30fps on an 8GB card.

The K2 NPNG doesn't deviate from a typical action camera design, and looks like a cross between the GoPro Hero4 and Rollei's ActionCam range. Without the waterproof case and LCD screen it's a fraction larger than a GoPro, and its lens sticks out a little further.

Inside the waterproof case it's considerably chunkier, however. There are two waterproof backs you can attach to the case, depending on whether or not you're using the LCD screen. With the screen attached the whole package is large, heavy and cumbersome, although at least the waterproof case allows you to go to depths of 100m, which is considerably deeper than most rivals.

The controls can be slightly fiddly until you're used to them. The front of the camera



The K2 NPNG shoots video at up to 1080p resolution at 60fps, or 720p at 120fps. Rival cameras shoot at up to 240fps, albeit at low resolution, but merely having the option of 1080p at 60fps is great given the price of the camera. It captures still images at up to 16 megapixels and offers photo burst modes and timelapse options too. A built-in gravity sensor can automatically start the camera recording when it detects any big movements.

The quality of video captured outside was respectable considering the K2 NPNG's budget price. Colours in particular were rich and vibrant. However, video was a little noisy and soft around the edges, even in ample sunlight. Still images were good but not spectacular. High-contrast scenes suffered from occasional chromatic aberration around the edges and sometimes appeared a little washed out, but for the money the results are more than adequate.

Battery life is one of the K2 NPNG's strongest points. The user-replaceable battery provided 2h 30m of video capture at 1080p and 30fps, which puts most other action cameras save for the 4GEE Action Cam to shame. The companion app on iOS and Android is a little basic but works well enough, although there is a slight delay if you use it as a viewfinder.

There's a lot to like about the Veho Muvi K2 NPNG action camera. It's more than capable for those who don't want to spend a lot of money, and the generous accessories make it fantastic value. Excellent battery life is the icing on the cake. The camera's controls might be confusing at first and it's a bit heavy in its waterproof case, but aside from these niggles there are few reasons not to recommend the K2 NPNG as a budget choice.

Richard Easton

The waterproof case allows you to go to depths of 100m, which is considerably deeper than most rivals

flat and curved surfaces, a right-angle mount and a helmet front mount. You can also use GoPro mounts with the camera. Every mount works with or without the waterproof case, which will help cut down weight when doing activities that don't involve water.

A version of the Muvi K2 is available without these accessories for around £30 less, but the K2 NPNG version is easily worth the extra. Other manufacturers charge more than that for a hard carry case alone, so the K2 NPNG is more than worth the extra money once you factor in the LCD screen too.

You also get an 8GB microSD card, although you may want to reserve this as a backup and buy a larger card for general use.

has two toggle switches, one for power and the other for Wi-Fi. There are two separate shutter buttons too, one for video on the front of the camera and the other for photos on the top. A first press of either button selects that function, while a second press begins capture. This means that if you're in video mode, you need to press the photo shutter button twice to capture an image. Strangely, there's even a separate stop button to end video recording.

The waterproof case makes it even harder to remember which button is which, as the markings are difficult to see, especially when you're in the thick of whatever activity you're trying to record. Until you've memorised their positions, there's a good chance you'll press the photo shutter button instead of stop.

Once you're familiar with them, however, the ability to capture photos without having to dive into menus is very convenient. It means you're more likely to head home with a good mixture of photos and videos than with other cameras, where you can get stuck shooting in one mode rather than having to swap between them constantly.



SPECIFICATIONS

SENSOR Not disclosed • SENSOR PIXELS 16,000,000 •
MAX RECORDING RESOLUTION 1080p (60fps) • AV
CONNECTIONS Mini HDMI • DIMENSIONS 40x23x60mm
• WEIGHT 84g • WARRANTY One year RTB • DETAILS
www.veho-muvi.com • PART CODE VCC-006-K2NPNG

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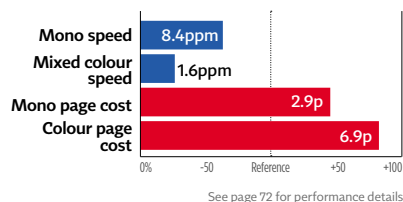
VERDICT

The MX495 isn't perfect, but it's great if you're setting up a home office on a budget

THE PIXMA MX495 is a small inkjet MFP that can print, scan, copy and send or receive faxes. It's smart with a 20-page automatic document feeder (ADF) built into the lid, so you can leave it to copy longer documents, or send a multi-page fax. There's support for USB and Wi-Fi connection but no front-panel

SPECIFICATIONS

TECHNOLOGY Thermal inkjet • **MAXIMUM PRINT RESOLUTION** 4,800x1,200dpi • **MAXIMUM OPTICAL SCAN RESOLUTION** 600x1,200dpi • **DIMENSIONS** 189x435x295mm • **WEIGHT** 5.9kg • **MAXIMUM PAPER SIZE** A4/legal • **WARRANTY** One year RTB • **DETAILS** www.canon.co.uk • **PART CODE** 0013C008



USB or wired Ethernet port – we wouldn't necessarily expect either at this price.

When not in use, the ADF's input tray folds shut. A 100-sheet paper tray in the base slides out but can't be removed, and printed pages are spat into a decent, if flexible, output tray above it. While this MFP can't print on both sides of the paper automatically, the driver will help you do it manually.

To the left of the ADF is a control panel with a mono display, but it's a little fussy – doing anything involved one more step or confirmation than expected. Joining Canon's Pixma Cloud Link service was a mission: you need to print a code from the printer, which is valid for only an hour, visit a URL that's hard to type, register, answer an email and create a username before you can get started.

Even over USB this is the slowest printer we've tested for a while. It delivered a first page of text in just 14s but managed only 8.4 pages per minute (ppm) over 25 pages. Colour pages crept out at a glacial 1.6ppm. We've



seen facial hair appear more quickly than this printer's 6x4in photo prints, each of which took almost six minutes. Photocopies were slow, particularly in colour: 10 A4 pages took seven and a half minutes. Scan speeds were more competitive, with even a 1,200dpi scan of a 6x4in photo taking less than a minute.

Fortunately the results gave us little to criticise. Scans were much better than average for a budget device, with sharp focus and great detail. Photocopies were also great, and text and graphics were fine on plain paper. Those with sharp eyes might spot a touch of grain in photos, but they weren't bad.

Ink cartridges come in two sizes. Using the larger of these, costs are a reasonable 6.9p per A4 page of text and graphics, although the black component is a steep 2.9p. Given its low price, capable features and good results, this is a great budget office MFP, but with slow print speeds and high black costs, we'd only recommend it for light to moderate use.

Simon Handby

COLOUR MFP

XEROX WorkCentre 6027



£248 inc VAT • From www.morecomputers.com

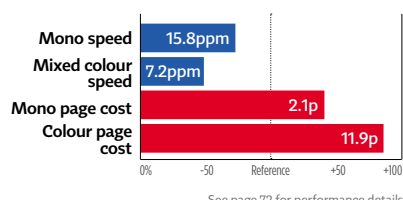
VERDICT

The WorkCentre 6027 produces lovely prints, but it's blown away by the best inkjet alternatives

THE WORKCENTRE 6027 is an entry-level colour MFP with a huge colour touchscreen. It looks smart and feels well made, but there's no getting away from its entry-level status: the paper input tray holds just 150-sheets, there's no bypass feed for one-off media and

SPECIFICATIONS

TECHNOLOGY Single-pass colour LED • **MAXIMUM PRINT RESOLUTION** 1,200x2,400dpi • **MAXIMUM OPTICAL SCAN RESOLUTION** 1,200x1,200dpi • **DIMENSIONS** 388x410x439mm • **WEIGHT** 16.9kg • **MAXIMUM PAPER SIZE** A4/legal • **WARRANTY** One year onsite • **DETAILS** www.xerox.co.uk • **PART CODE** 6027V_N1



the ADF holds only 15 sheets. There's also no automatic double-sided (duplex) printing.

Given the basic paper handling, we were surprised to see high specifications elsewhere. The touchscreen is clear, responsive and mostly quick and easy to use. There's a USB host port for walk-up printing or scanning, and you can share the MFP over a wired or wireless network. It even supports print languages including PCL6 and PostScript 3.

Xerox claims a modest 18 pages per minute for this printer, and it's certainly in no hurry. With the PCL driver we measured a leisurely 15.8ppm on our 25-page mono letter test, while our graphics-rich colour test limped out at 4.7ppm – we've seen faster budget inkjets. Switching to the PostScript driver improved the colour speed, but only to 7.2ppm.

The results were generally good, with reasonably sharp scans. Xerox's TWAIN scan interface is simple without being overly helpful: there's no auto-exposure, and we had



to tweak this manually on some scans. Mono photocopies weren't perfectly exposed, and colours in colour copies weren't perfectly accurate. Print quality was superb, though, with sharp text, accurate colours and no sign of artefacts or obvious half-toning.

The 6027 is undermined by its running costs. Its four consumables are rated for only 500 pages, and replacements last 2,000 pages in black and 1,000 pages in each colour. The cost per A4 page works out at 2.1p in black or 11.9p for text and colour graphics. Epson's WorkForce WF-5620DWF inkjet doesn't support PCL or PostScript 3 and can't match this printer's exceptional print quality, but it's cheaper and faster, supports duplex printing and scanning, has a three-year warranty and costs almost three times less to run.

Simon Handby

NEST Nest Cam

COMPUTER
SHOPPER



RECOMMENDED

£159 inc VAT • From www.pcworld.co.uk

VERDICT

A delightfully simple IP camera that neatly integrates with Nest's other smart home tech

NEST, THE COMPANY behind the original smart thermostat and the smartphone-connected Protect smoke alarms, bought IP camera company Dropcam last year and has now launched its first Nest-branded camera. The Nest Cam is an evolution of the Dropcam camera and is designed to slot into Nest's range of smart home equipment.

The camera is incredibly simple, with a clean, stylish design. The 1080p sensor sits on an articulated stem for easy adjustment, with a magnetic base that lets you fix it to a fridge or kitchen appliance without any screws. A tripod thread in the bottom will let you fix it just about anywhere else as well.

You simply connect the power adaptor to get the Nest Cam online, as setup is handled through iOS and Android companion apps. The camera connects to your Wi-Fi network without needing a base station. When adding a new Nest product through the app, you use your smartphone's camera to scan the QR code on the back of each device. Your phone then connects to the Cam directly, letting you add your router's Wi-Fi details.

The apps let you adjust settings, change video quality and set schedules for when you're home and don't need the camera to record, but the most useful function is live view. You can get a live feed anywhere you have mobile phone reception, and the frame rate was remarkably high even over 3G. You can toggle between 1080p and 720p recording, but image quality, particularly in faces, remains excellent at the lower setting.

With all your footage uploaded to the cloud, you don't have to worry about someone stealing the camera and leaving you with no way to identify them. Placing the camera in a prominent position should help you identify intruders, and picture quality remains high at night thanks to the infrared night vision LEDs. Its image quality is among the best we've seen from an IP camera.

A DOG'S LIFE

There's also a microphone and speaker, which you can use to listen in through the app or speak through your smartphone. There's a second or so of delay between you speaking and the sound being produced by the camera, but it's ideal if you want to use a Nest Cam to keep an eye on your pets. A quick "get down" will let your dog know it's not OK to take over the sofa while you're at work.

The web interface is almost identical to the smartphone app, so it's easy to move between the two. There's nothing in one that isn't also available in the other. You'll definitely want to set up a schedule, however – when we first installed the camera in a hallway we received hundreds of notifications a day. Setting the camera to record motion only at night should prevent any false alarms.

Nest Cam plays nicely with other Nest products, as you'd expect. If your Protect alarm detects smoke, Cam starts recording

while the alarm sends an alert notification to your smartphone. Switching your Thermostat to the 'Away' mode automatically turns on the camera, and returning to 'Home' mode deactivates it

so you don't need to worry about triggering a movement notification when walking around the home. However, that's

as far as integration goes. Both Protect and the Thermostat talk to other devices using the IFTTT service (ifttt.com) but the Nest Cam is a standalone product. You can toggle Home and Away functions in the smartphone app, even if you don't have a Nest Thermostat, but notifications still came through during Home hours – for now, schedules seem to be the best way to prevent false alerts.

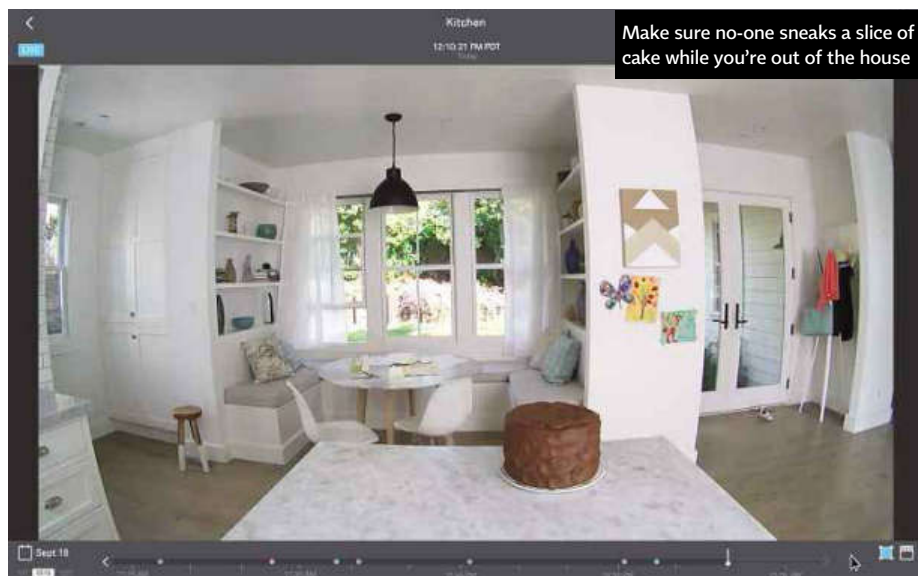
SERVICE ENTRANCE

Unfortunately, Nest Cam is rather limited in the UK, as the Nest Aware 30-day video history service isn't yet available. You're restricted to 10 days of backups, which are deleted once their lifespan expires. You can't save clips without a subscription, and even then you're limited to three hours' worth.

Ten days of cloud-stored footage should be enough for most, especially if you only have one camera, but tying advanced features – such as activity zones and face-detection to avoid false alerts – to the subscription service feels stingy, especially when the service isn't even available in this country.

Nest Cam is a brilliantly simple way to add a security camera to your home, and it comes into its own if you have other Nest products, but even as a standalone camera it's easy to use through its app and offers superb picture quality. You don't need a base station, the attractive design means you won't have to hide it out of sight and at £159 it's not badly priced either. Until Nest Aware launches in the UK, however, it's rather limited in its advanced features. Netgear's battery-powered Arlo cameras may cost more but they currently offer more modes and settings.

Tom Morgan



SPECIFICATIONS

SENSOR 1/4in CMOS • VIEWING ANGLE 130° diagonal •
VIDEO RECORDING FRAME RATES 1080p (30fps) • NIGHT
VISION MODE Infrared LEDs • DIMENSIONS 73x114x73mm
(base) • WEIGHT 203g • WARRANTY Two years RTB •
DETAILS www.nest.com • PART CODE 143349

WIRELESS EXTERNAL HARD DISK

TOSHIBA Canvio AeroCast

COMPUTER
SHOPPER
RECOMMENDED



£94 inc VAT • From www.ebuyer.com

VERDICT

The perfect storage device for anyone who works across laptops, tablets and mobile

EXTERNAL STORAGE IS essential for anyone who has an Ultrabook, Chromebook or hybrid laptop with only a small amount of storage, but it's becoming increasingly important for tablet and smartphone owners, too. Apple refuses to make 32GB the standard for its entry-level iPhones and iPads, meaning some make do with a tiny 16GB of storage, and a surprising number of Android-powered devices are now ditching microSD card expansion, including Samsung's Galaxy S6.

Toshiba's Canvio AeroCast can help. It's a 1TB portable hard disk with built-in Wi-Fi and a companion app for sharing files between computers, tablets and phones. It even has an SD card reader to help you transfer files between a camera and a handheld. Despite all the wireless upgrades and SD card slot, the AeroCast is barely any larger than a standard portable hard disk – it's a major improvement over the massive Seagate Wireless, which was impossible to slip in a pocket.

Seagate's disk was limited to USB2 transfer speeds, but the AeroCast's USB3 interface immediately makes it more practical as an

external hard disk, as you won't be waiting around for your files to copy. In our wired file transfer tests, the AeroCast consistently reached the maximum throughput of its internal 2½in hard disk. In both our huge file and large file tests, read and write speeds hovered around 108MB/s, and even the small files test averaged around 103MB/s. This is about as good as you can expect from a mechanical hard disk – the only way to go faster would be with flash storage.

The disk is formatted as NTFS, but you won't need to reformat to use it with a Mac as a driver for adding NTFS write support to OS X is included. This makes transferring files between operating systems much easier.

Holding down the power button switches on Wi-Fi, which lets you connect to the disk directly using its own SSID

Another useful addition is the SD card slot, which you can use to access photos when the AeroCast is connected to a PC over USB, even if your computer has no SD card slot. You can choose whether to back up the card automatically whenever you plug it in, or to copy files manually using your computer or a smartphone companion app, but there's no way to erase the card automatically after a complete backup. This is only a minor frustration, though, as you can simply erase the card when you put it back in your camera.

It's with Wi-Fi and the companion apps that the AeroCast really begins to make sense. Apps are available for iOS and Android, and although the app has yet to be updated for iOS 9, it makes transferring files between a PC and an iOS 8 or Android handheld a breeze.

Holding down the power button on the edge of the AeroCast switches on Wi-Fi, which by default lets you connect to the disk directly using its own SSID. You can also set it to pass-through mode and connect it to an existing wireless network so everyone on that network can map the disk as a network drive. There's no way to password-protect the disk, and it supports only 2.4GHz rather than 5GHz 802.11n Wi-Fi networks, so you'll need this mode enabled on your router.

The app separates files into music, photos, videos and documents, with thumbnails for each. You can play most multimedia content in the app, although some file formats including MKV video aren't supported

natively. The app scans your storage each time you open it, so new files appear automatically. There's also a one-touch backup function to transfer photos and videos from your phone to the disk.

The app's Google Cast support lets you send content to the big screen without having to copy it to your handheld first. DLNA isn't supported, though, so you can only access your content on smart TV with Google Cast support (such as Android TV-powered sets) or through a Chromecast.

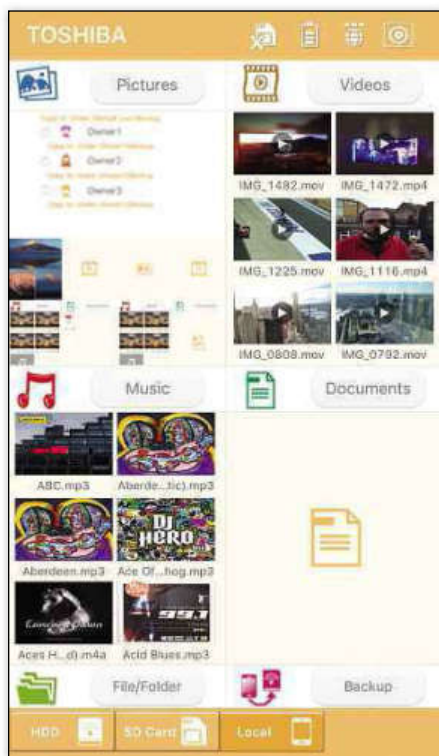
Toshiba expects you to get around five hours of battery life when using the AeroCast's Wi-Fi features, and this was roughly in line with our test results. A power

adaptor is included, and the drive draws power from a PC when connected over USB3.

The only major negative point is manual file management. Seagate's Wireless drive includes a free media sync app that runs on a PC or Mac and automatically copies pictures, music and video files whenever you plug the disk in over USB. There's nothing similar for the AeroCast, so you have to drag and drop everything yourself. There's no web interface for accessing files on a PC or Mac over Wi-Fi either – you'll need to plug the drive in to do any serious file and folder transfers.

If you're only after a USB hard disk, the AeroCast is overkill – you'd pay around £35 more for features you won't use. However, if you work across multiple devices, including tablets and smartphones, or have a huge multimedia library but no capacity on your handheld devices, this is an excellent buy.

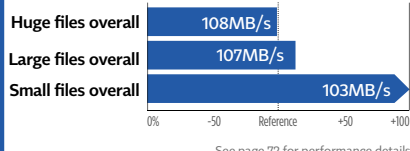
Tom Morgan



↑ The AeroCast's app doesn't look particularly stylish, but it provides everything you'd expect – including one-touch backup

SPECIFICATIONS

CAPACITY 931GB • **COST PER GIGABYTE** £0.09 • **INTERFACE** USB3, Wi-Fi • **DIMENSIONS** 122x86x24mm • **WARRANTY** One year RTB • **DETAILS** www.toshiba.com • **PART CODE** HDTU110EKWC1



THE POWER TO AMAZE

SAPPHIRE TRI-X RADEON R9 FURY

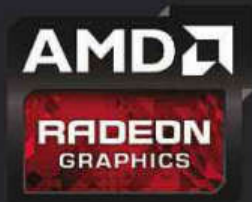
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- ▲ 4096-bit High Bandwidth Memory
- ▲ Extreme 4K gaming beyond 1440P
- ▲ Engineered for maximum gaming with Liquid VR, FreeSync and CrossFire support
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SAPPHIRE TRI-X™
RADEON R9 FURY Graphic Card



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MID-RANGE GRAPHICS CARD

MSI Radeon R7 370 Gaming 2GB



£119 inc VAT • From www.scan.co.uk

VERDICT

It doesn't cost much, but the R7 370's ageing architecture can't compete with Nvidia's for performance

AMD'S LATEST GRAPHICS cards may not be based on entirely new silicon – as we discovered with the R9 380 (see *Reviews*, *Shopper* 332) – but they're still seriously good value. The Radeon R7 370 is no exception: it's a 2GB card built for 1080p gaming, but will set you back only £120.

The price is so low because AMD has reused an old GPU design for the card, adjusting clock speeds and refining drivers rather than producing an entirely new graphics architecture. This means the R7 370 uses a slightly tweaked version of the GPU found in the three-year-old Radeon HD 7850. It's still built on a 28nm process, with 1,024 stream processors running at a 975MHz boost clock – roughly a 100MHz increase over the HD 7850's speeds. Of course, third-party manufacturers will be overclocking the chip for their versions of the card.

With 2GB of 5.7GHz GDDR5 RAM accessed through a 256-bit memory bus, the R7 370 isn't exactly starved of memory bandwidth, but only if you stick to 1,920x1,080 resolutions. Stepping up

There are plenty of Radeon R7 370 models to choose from, with versions appearing from most of the major graphics card manufacturers, but we tested an MSI card for this review. The Radeon R7 370 Gaming 2GB uses the same twin-fan custom cooler we last saw on MSI's Nvidia GeForce GTX 960, complete with glowing MSI Dragon logo on the edge of the card. It also comes overclocked – MSI has increased the core clock speed to 1GHz and raised the boost clock to 1,050MHz, giving it around a 10% performance increase over a stock card.

With a surprisingly low (for an AMD card, at least) thermal design power (TDP) of 110W, the R7 370 doesn't exactly pump out heat, and MSI's custom Twin Frozr V cooler does a brilliant job of keeping the GPU core cool. What's more, the fans don't spin up at all when temperatures are below a certain threshold, so you can work on the Windows desktop without any noise from the graphics card at all. The twin fans spin up to audible

frame at 2,560x1,440. Disabling SSAA in favour of less-demanding FXAA in *Tomb Raider* helped boost frame rates significantly, bringing the game above the magic 60fps we consider to be perfectly smooth. Disabling anti-aliasing altogether couldn't do the same for *Metro*, however, with frame rates hovering in the mid-40s until we reduced tessellation and texture quality.

2,560x1,440-resolution gaming isn't out of the question on this card, but only in older titles or with considerably lower detail settings. A score of 46.5fps in *Dirt Showdown* is respectable, and disabling anti-aliasing helps average out the frame rate to around 60fps, but even with SSAA disabled, both *Tomb Raider* and *Metro: Last Light Redux* averaged around 25-30fps depending on the amount of onscreen action.

Not surprisingly, Nvidia's more expensive GeForce GTX 950 consistently outperformed the R7 370 in our tests at 1,920x1,080. For £15-20 more, depending on the manufacturer, we typically saw a 10-15% performance increase from Nvidia's card. This was enough of a boost to make 2,560x1,440 gaming slightly more manageable in newer titles, too.

At £120 the Radeon R7 370 is fairly good value if you're looking for a graphics card that can handle 1080p gaming, but it isn't powerful enough to play newer titles at their maximum settings, and higher resolutions are out of the question without slashing detail levels. The lack of 4K support over HDMI is admittedly a niche issue at the moment, but in a year or two's time it could become frustrating. Nvidia's GeForce GTX 950 offers superior performance for only £10-20 more and is worth the extra cash.

Tom Morgan

The Radeon R7 370 is fairly good value if you're looking for a graphics card that can handle 1080p gaming

to 2,460x1,440 or even 4K puts much greater demand on the GPU memory and can send frame rates tumbling.

There's also some confusion over which of AMD's cards support DirectX 12 – and which feature levels in particular. The R7 370 supports Feature Level 11_0, which includes, most importantly, the low API overhead that should result in better performance when DirectX 12 games finally arrive. Other effects such as conservative raster, which should improve shadow effects and cut down on those unsightly jagged edges, aren't supported.

Although the card lacks the processing power to run games at 4K resolutions, it's still a pity that AMD has decided not to add a HDMI 2.0 video output for UltraHD video playback at 60fps on a compatible TV. At least you can output 4K at 24fps over HDMI 1.4a, or use a 4K monitor over DisplayPort for 60fps playback if you have the right ports.

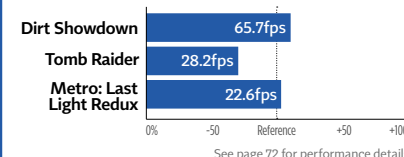
levels when gaming, but they're not so loud that you'll notice them in a well-ventilated case. However, you'll struggle to fit the card into anything smaller than a microATX chassis as the custom cooler makes the card a substantial 258mm long.

For a graphics card that's designed purely for 1,920x1,080-resolution gaming on a budget, the R7 370 copes surprisingly well in newer titles as long as you're realistic with graphics settings and anti-aliasing. It easily handled older games, including *Dirt Showdown*, where it produced 65.7fps, but the incredibly demanding super-sampling anti-aliasing used in *Tomb Raider* and *Metro: Last Light Redux* sent frame rates down to 28.2fps and 22.6fps respectively.

This form of anti-aliasing in effect doubles the rendering resolution of a given title before down-sampling it to fit your monitor's resolution, so it's no surprise to see that the R7 370 struggles – it's actually rendering each

SPECIFICATIONS

GPU AMD Radeon R7 370 • MEMORY 2GB GDDR5 • GRAPHICS CARD LENGTH 258mm • WARRANTY One year RTB • DETAILS uk.msi.com • PART CODE R7 370 Gaming 2G



See page 72 for performance details

AOC



Q2577PWQ

Cutting-edge features, stylish good looks

The new Quad HD panel ensures that users can enjoy a full view of a website at a single glance without image distortion. IPS technology is one of the highest performing panel technologies currently available for displays. This way, AOC makes sure users will greatly benefit from high accuracy in colour, contrast and wide viewing angles. In order to give users a variety of options for connecting different input sources, the AOC Q2577PWQ comes with DisplayPort, HDMI, DVI and VGA. Also comes with a feature that ensures a zero-flickering viewing experience.

New 32-inch size available from July 2015

www.aoc-europe.com

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OVERCLOCKERSUK

[SCAN
computers](http://SCANcomputers)

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TECHNOLOGY](http://ariaPC)

ATX CASE

SILVERSTONE Kublai KL05

COMPUTER
SHOPPER
RECOMMENDED



£45 inc VAT • From www.scan.co.uk

VERDICT

This case has comprehensive storage and cooling options at a bargain price

ATX MEDIUM-TOWER cases are less popular with manufacturers now that you can squeeze top-end components into smaller microATX cases, but they have their uses. Anyone who builds their own PC will appreciate the extra room to work in, and the flexible layout makes them ideal for water-cooling kit. SilverStone's Kublai KL05 is a perfect example, with plenty of room for storage or water-cooling radiators, yet will only set you back £45.

Made of steel, with a brushed metal-effect plastic front panel, the KL05 looks pricier than it is. At 6.9kg it's not exactly heavy, and closer inspection reveals why: the steel is rather thin and feels cheap. This model has a mesh front

to improve airflow and a windowed side panel to show off the components within.

The blue LEDs on the front intake fan won't appeal to everyone, but otherwise the KL05 looks subtle for a mid-tower case. The front I/O panel is sparse, with just two USB3 ports and two 3.5mm audio jacks above the two external 5¼in drive bays.

The KL05 is surprisingly thin, but besides leaving less room behind the motherboard tray for cables, this has little impact on the space inside the case. With the hard disk cages in place, you can fit 280mm-long graphics cards and up to six 2½in or 3½in storage drives. Pull them out using the tool-free thumbscrews, however, and you'll create room for 405mm graphics cards. Two 2½in SSD mounts on the motherboard tray give you somewhere to bolt down your disks if you rip out the HDD cages. A giant cutout in the motherboard tray leaves space for a CPU cooler backing plate, and further cutouts



at the edge of the tray help keep the number of visible

cables to a minimum, although they rely on rolled-steel to protect your cables rather than rubber grommets.

The single 120mm intake fan cooled our reference system reasonably well, but if you fill the case with hot components, you'll need at least one exhaust fan. The KL05 really shines if you want to water-cool your hardware, as there's room for 240mm or 280mm radiators at the top and bottom of the case, plus a 240mm radiator in the front if you remove the intake fan. The more water-cooling radiators you fit in a case, the slower the fans can spin and the quieter your PC will be.

With an almost completely tool-free construction, comprehensive cooling options and a spacious interior, the KL05 is a flexible case for the price. As long as you don't expect premium materials, and don't mind the rather boxy design, it's an excellent choice.

Tom Morgan

SPECIFICATIONS

CASE TYPE ATX mid-tower • **MOTHERBOARD COMPATIBILITY** ATX, microATX • **SUPPLIED FANS** 1x 120mm • **MAX 3½in DRIVE BAYS** 6 • **MAX 5¼in DRIVE BAYS** 2 • **DIMENSIONS** 200x494x525mm • **WEIGHT** 6.9kg • **WARRANTY** One year RTB • **DETAILS** www.silverstonetek.com • **PART CODE** SST-KL05B-W

MID-RANGE GRAPHICS CARD

EVGA GTX 960 SuperSC ACX 2.0+

COMPUTER
SHOPPER
BEST BUY



£188 inc VAT • From www.scan.co.uk

VERDICT

4GB of RAM gives EVGA's overclocked GTX 960 the edge at 2,560x1,440 and 1080p too

THE NVIDIA GTX 960's reference design has 2GB RAM, but games such as The Witcher 3 and GTA 5 are beginning to demand more. Previously, gamers would have had to step up to the more expensive GTX 970 to get 4GB of video memory, but now EVGA has released the first GTX 960 we've seen with 4GB.

The GTX 960 SuperSC ACX 2.0+ is an overclocked card with heavy duty cooling. It

takes an 8-pin rather than 6-pin PCI Express power connector, which delivers more power for overclockers looking to squeeze even more performance out of the GPU.

Its two cooling fans don't spin up at less than 60°, making the card silent on the Windows desktop, and even when they kick in, they're quiet. At 257mm long, however, this card may not fit easily in smaller cases.

Not only does the SuperSC have one of the highest base clocks we've seen in a GTX 960, but the 1,342MHz boost clock is the furthest we've seen a manufacturer push the GPU. As a result, it outperforms every other GTX 960 we've reviewed. A 90.9fps score in Dirt Showdown at 1,920x1,080 is 3fps higher than the 2GB Asus STRIX GTX 960's, while 46.7fps in Tomb Raider is around 10% faster at the same settings. There's less difference in Metro: Last Light Redux, but 30.8fps is still respectable, and disabling the intensive SSAA anti-aliasing boosts frame rates into the 60s.



As soon as you move up to 2,560x1,440, you need to drop detail settings to maintain a healthy frame rate in most games, but older titles are playable at maximum settings, although 4K gaming isn't really possible without dropping to Medium detail settings in most modern titles. The similarly priced 4GB AMD Radeon R9 380 trades blows with the EVGA at all resolutions, but while it comes out on top in Tomb Raider, it consistently falls behind in Dirt and Metro by around 3-5fps.

In our tests, the SuperSC's extra 2GB of RAM provided no immediate benefit to frame rates, but with 2GB and 4GB cards available at a similar price, there's no reason not to pick the card with more memory.

AMD still has a slight edge for price, but the GTX 960 is a competitive mid-range card and offers full HDMI 2.0 support for 4K video playback at 60fps. If your budget is roughly £190, it's easily the best card to buy right now.

Tom Morgan

SPECIFICATIONS

GPU Nvidia GeForce GTX 960 • **MEMORY** 4GB GDDR5 • **GRAPHICS CARD LENGTH** 257mm • **WARRANTY** Three years RTB • **DETAILS** www.evga.com • **PART CODE** 04G-P4-3967-KR

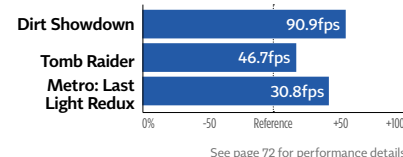


PHOTO-EDITING SOFTWARE

COREL PaintShop Pro X8 Ultimate



£80 inc VAT • From www.paintshoppro.com

VERDICT

High-quality Raw processing joins the ranks, but PaintShop Pro still lags behind its rivals

PAINTSHOP PRO HAS a long history of coming second in our reviews. There's plenty to admire but it couldn't match the attention to detail and performance of Adobe Photoshop Elements. Neither application has progressed much in recent years, so it was only a matter of time before something came along to usurp them both. That turned out to be Adobe Creative Cloud Photography Plan, which for £103 a year provides our two favourite image-editing applications, Photoshop CC and Lightroom. It's much more appealing than upgrading PaintShop Pro or Photoshop Elements for around £50 a year. Corel needed to hit back with something special to avoid being relegated to third place.

As usual, there's a standard version of PaintShop Pro X8 (£60) and an Ultimate version (£80) with additional modules. One of these is more substantial than the usual lightweight extras. Corel AfterShot 2 is a powerful photo-management and Raw-processing application. It's not quite a match for Lightroom but it comes close. Library

A new Magic Move feature lets you select an area of the image and drag it to a new location

management is elegant and sophisticated, with the ability to filter by multiple metadata such as date, lens model, keyword and star rating. Raw processing is excellent, offering surgical precision over colours and quick screen redraws as settings are adjusted. The ability to create freeform masks to colour-correct specific areas of the frame is particularly welcome. As Raw file handling was one of PaintShop Pro X7's weakest areas, this development bodes well.

Sadly, AfterShot isn't quite the success it could be. For one thing, it's AfterShot 2 and not AfterShot Pro 2 (see *Reviews*, *Shopper* 320). There seem to be few differences, but this version lacks the Local Contrast filter for creating punchier details and the highest-quality noise-reduction algorithm.

More disappointingly, there has been no attempt to integrate the applications. There's no button or command to send an image from one to another. AfterShot is a non-destructive editor, saving edits as instructions in an XMP file. PaintShop Pro doesn't recognise these, so

any Raw editing you do in AfterShot is ignored in PaintShop Pro unless you export from AfterShot as a new file.

The main PaintShop Pro application still has two independent Raw processing engines for its Adjust and Edit modes, both of which score poorly for quality. The former looks like a non-destructive editor but in fact saves edited Raw images in another format, locking in edits and generating extra files. Even the Adjust and Edit modes seem unaware of each other. When we tried to take a Raw file from the Adjust to the Edit tab, the software saved the edited image in a proprietary PSPIMAGE format. It then disregarded this saved file, went back to the original Raw file and offered to process it from scratch in the Edit Mode's woefully inferior Raw Lab editor.

You can work around these issues by using

AfterShot for all Raw processing and saving as JPEGs before importing into PaintShop Pro for layer-based editing. Photoshop Elements is more elegant in the way it handles Raw files, though, and it delivers superior quality. Lightroom and Photoshop CC up the stakes yet again with powerful non-destructive editing and Smart Objects that create dynamic links across the two applications.

Another setback for AfterShot is its poor camera support. We supplied Raw files from 14 cameras, but it could only import seven. Lightroom opened all 14, as did the main PaintShop Pro editor's inferior Raw modules.

PaintShop Pro has some new features of its own. Text can be made to flow around shapes, a common technique for desktop publishing (DTP) software but rarer for image editors. It's very easy – make a selection, pick the Text tool, click inside the selection and start typing. The downside is that you can't amend the shape after entering text. With DTP software, text flows around objects, so the text reflows as objects are moved.

A new Magic Move feature lets you select an area of the image and drag it to a new location while the software patches up the old location by cloning from nearby areas. It's essentially the same as Photoshop Elements' Content-Aware Move Tool and has the same limitations, handling random textures such as foliage well but struggling with complex objects such as buildings and people. Comparing the two applications side by side, neither produced flawless results but Photoshop Elements was consistently better.

There's better handling of layers and support for high-resolution monitors (so the interface doesn't become tiny). There's a new filter for correcting lens distortions, chromatic aberrations and vignetting, although it's of little use built into the Raw Lab module. It's also available for JPEGs in the main Edit mode, but the few times it identified the lens and offered a suitable profile, it didn't seem to have much bearing on image quality. Perhaps that's because most modern cameras already correct for lens defects in their JPEG output.

The most significant improvement is a performance boost when making brush strokes. Making large brush strokes with processor-intensive tools such as Dodge and Burn was hopelessly unresponsive in version X7, but it's vastly improved this time around. Photoshop Elements is still faster, though.

AfterShot is the star of the line-up, but we wonder how many people will use it while PaintShop Pro continues to integrate its own, inferior, management and Raw-processing modules. AfterShot 2 is available on its own for just £12, and Raw shooters on a budget may as well buy that. For layer-based editing and the best Raw processing available, Adobe's Creative Cloud Photography Plan keeps the top honours, followed by Photoshop Elements. PaintShop Pro must settle with third place.

Ben Pitt



SPECIFICATIONS

OS SUPPORT Windows 7/8/8.1/10 • **MINIMUM CPU** 1.5GHz
MINIMUM GPU DirectX 9 • **MINIMUM RAM** 2GB (4GB recommended) • **HARD DISK SPACE** 1GB (2GB recommended) • **DETAILS** www.paintshoppro.com

GRAPHIC-DESIGN SOFTWARE

XARA Photo & Graphic Designer 11

COMPUTER SHOPPER ★★★★★
BEST BUY

£50 inc VAT •

From www.xara.com/uk

VERDICT

Powerful new warping and brush tools take Photo & Graphic Designer to lofty new heights

XARA PHOTO & Graphic Designer has been a firm favourite for many years. Despite having access to CorelDraw and Adobe Illustrator, it's Xara we turn to whenever we need to design an invitation or logo, draw a diagram, create graphics for a video project, edit a PDF or figure out whether furniture will fit in a room. It lacks a few of the advanced features of its pricier rivals, but it's the ease of use and the speed at which it handles core graphic design tasks that keeps us coming back.

The relative simplicity means there's plenty of scope for new features, and that's certainly the case in this update. The Shape Painter Tool was introduced in version 9 as a way to generate vector shapes using brush strokes. In version 11 it's joined by tools for warping vector shapes by pushing them around the screen. It's similar to Photoshop's Liquify editor but for vectors rather than bitmaps, with a choice of Warp, Bloat, Pucker and Twirl brushes that move, enlarge, shrink and twist shapes. It's also similar to CorelDraw's Smear tool, but whereas CorelDraw shows the outline of shapes while they're being edited and only updates the full-colour preview after the mouse button is released, Xara updates the preview as edits are made. This is true of virtually any edit in Xara, and it's this constant feedback that makes it rewarding and quick to use. It's a superb addition to the set of vector editing tools, and worth £35 on its own.

CUT A DASH

Xara's brushes were previously limited to dashed patterns, a handful of basic natural



The Warp Brush is ideal for rearranging the shape of text or other vector graphics. Meanwhile, the new blend modes combine colours in complex ways

media brushes and novelty effects such as airbrush, chalk and footprints. Now there are far more options, and they're generally better quality. They're grouped into categories such as Acrylic, Hair & Fur, Lines & Hatchings and Watercolour. Unlike natural media painting effects in bitmap editors and software such as Corel Painter, brush strokes are still accessible as vectors, which makes altering their shape easy. However, each brush preset is largely fixed, and multiple strokes of the same type look very similar. As before, you can turn any vector object into the basis of a brush – great for adding a sprinkling of stars or bubbles.

BLENDER REASSIGNMENT

Blend modes are common in image-editing software, mixing colours in overlapping objects in complex ways. Xara's blend modes now use the same names and processes that are available elsewhere, such as multiply, screen, overlay, soft light and luminosity. The results are better than from the slightly crude blend modes of previous versions. Even so, it's good to see that projects created in version 10 loaded correctly – the old blend modes are hidden but still available.

The list of minor features is long, such as the ability to generate spirals and readymade boxes for dropping in a photo and caption. You can customise these using simple handles rather than grappling with the underlying

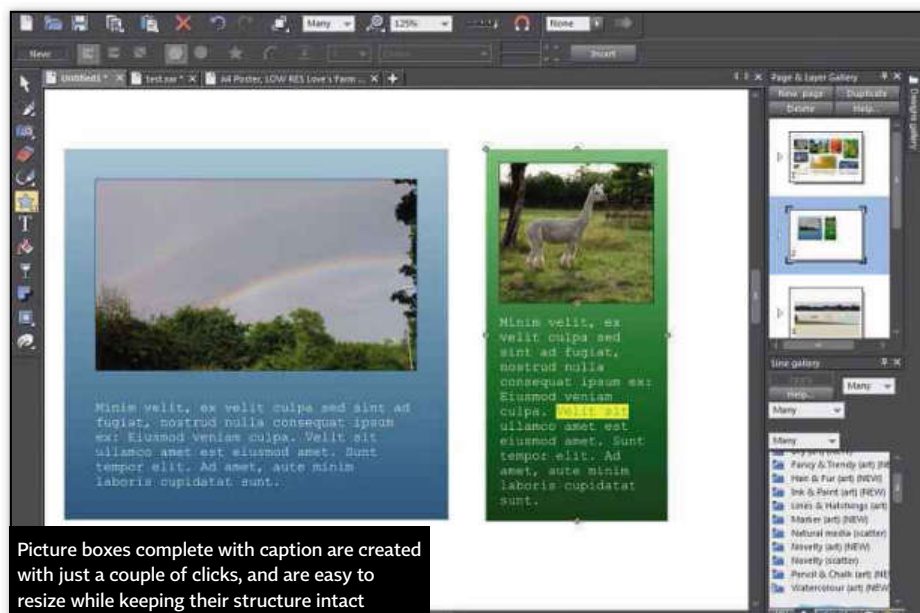
vector tools. Text can be given a background colour – ideal for highlighting a passage. PDFs with embedded fonts can be imported when the font isn't installed locally, and fonts can be replaced *en masse* with a right-click option.

The name of the software suggests that it's as much about photos as vector graphics. Xara isn't a true bitmap editor with the ability to open, edit and save photos at their native resolution – instead you have to use the Export menu and choose suitable settings to maintain quality. Even so, Xara can do a lot with photos, whether on their own or as part of a larger graphic design project. The highlight is the bundled copy of Magic Bullet PhotoLooks 2, which first appeared in version 10 and provides a suite of photo filters. These are all about evoking a mood and bringing out colours and detail, and there are some stylish presets plus meticulous control over settings.

Back in the main interface, there are options to colour-correct, clone, heal, stitch panoramas and change the aspect ratio of photos without distorting the subject. There's also a selection of more conventional filters such as blur, warp and pencil sketch. Unlike in conventional bitmap editors, these filters are applied non-destructively so you can always go back and amend or remove these effects.

As a serious graphic design and desktop publishing tool, Photo & Graphic Designer is limited by its lack of CMYK support, page-numbering and advanced text-formatting tools. Xara Designer Pro X11 is better for these, although at £220 it's a lot more expensive. Photo & Graphic Designer also lacks Raw-processing and conventional layer-based bitmap editing tools, so most people will also need an image editor such as Photoshop Elements. However, Xara takes a wide range of other graphic design tasks in its stride. It's competitively priced, and we're glad to see it going from strength to strength.

Ben Pitt



Picture boxes complete with caption are created with just a couple of clicks, and are easy to resize while keeping their structure intact

SPECIFICATIONS

OS SUPPORT Windows 7/8/8.1/10 • **MINIMUM CPU** Celeron, Sempron or newer • **MINIMUM GPU** N/A • **MINIMUM RAM** 500MB • **HARD DISK SPACE** 300MB • **DETAILS** www.xara.com/uk



How 3D-printed rats could offer schools a vegetarian dissection

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alphr.com

A fresh take on technology

OPEN-WORLD STEALTH ADVENTURE

KONAMI

Metal Gear Solid V: The Phantom Pain

COMPUTER SHOPPER

★★★★★

BEST BUY

£28 inc VAT •

From www.cdkeys.com

VERDICT

Some of the best gameplay of any open-world game we've ever played

IT'S 1984. Three Spetsnaz commanders are conducting a secret meeting at a remote Afghan military base. It's 1pm and the sun is blazing. I ride my trusty horse down an unguarded maintenance road, keeping out of sight until I'm right outside the base. After crawling through a drainage tunnel I emerge next to the meeting point. Three shots from a tranquilised pistol put my targets to sleep, but they are too valuable to kill. Instead, I attach a Fulton balloon to each soldier and send them floating into the sky, ready to be retrieved by my support team. I crawl back outside and ride by horse off into the sunset, undetected. Mission complete.

The Phantom Pain is a stunning example of how giving players an entirely open world can create myriad ways to approach a single objective. Hideo Kojima's stealth series might have started life with linear, story-driven adventures, but Metal Gear Solid V leaves almost everything up to player choice. The order in which you tackle each mission, the equipment and weapons in your loadout, the AI-controlled buddies you bring along with you, and what time of day you make your move can all be changed on the fly, often resulting in completely different experiences each time.

THREE'S COMPANY

It's 1984. Three Spetsnaz commanders are conducting a secret meeting at a remote Afghan military base. It's 3am and clouds are blocking out the full moon. I've just airdropped in on the mountains above the base with my sniper companion. She quickly spots the patrols, security cameras and my targets. We eliminate them with silenced rifles, then exfiltrate by foot. Mission complete.

Players are actively encouraged to mix up their strategies, as enemies quickly adapt to your methods. Helmets will be issued to soldiers if you rely overly on sniper rifles and headshots. Steal enemy resources without getting detected and surveillance cameras will begin appearing. Only attack at night and soldiers will soon be equipped with night vision goggles. The continual



This is just one of the many bases and outposts strewn over two massive maps

adaptation of the bad guys means you're constantly second-guessing what opposition you'll encounter on each new mission.

THE JOY OF SIX

It's 1984. Three Spetsnaz commanders are conducting a secret meeting at a remote Afghan military base. It's 6am and the sun is about to rise. I've decided against the subtle approach, ordering my helicopter pilot to hold position above the base, while I mark the targets below. Five seconds later an aerial bombardment rains down, blowing the meeting point to pieces as my helicopter flies out of the hot zone. Mission complete.

The game's Fox engine runs beautifully on the PC, with stunning draw distances and incredible object detail; protagonist Big Boss's sneaking suit creases convincingly as he runs, gets wet when it rains and gradually gets dirtier and bloodier as you spend time in the field without returning home for a shower. The attention to detail is simply staggering.

It helps that the controls are sublime, whether you're playing on a gamepad or with a mouse and keyboard. Big Boss can sprint, climb, crawl, peek around corners and hang from ledges in an effort to remain undetected, but you're also helped by a few seconds of slow motion when a guard does spot you. This tiny Reflex mode window gives you just enough time to score a headshot or land a quick punch and prevent a full alert.

At the outset you'll need to rely on close-quarters engagements, but you quickly amass a huge arsenal of gadgets and weapons that all create new gameplay possibilities.

The non-lethal approach makes more sense, though, as captured enemy soldiers can build up your home base and unlock new development options. It's hilarious to attach a Fulton balloon – which floats up into the sky to be retrieved by a cargo plane – to an unsuspecting enemy (and even more so to a sheep or armoured car), but it becomes a vital way to upgrade Big Boss's skills and inventory. You can add extra platforms and decks to make room for more soldiers,

and protect the base with security cameras, electric fences and decoys, which are essential to keep your workers safe from other players in multiplayer mode. Multiplayer is a brilliant addition, as invading other players' bases in an attempt to steal resources suits the series perfectly, but doing so makes you a target for retaliation. It's optional, too, so you can stick to offline mode if you prefer.

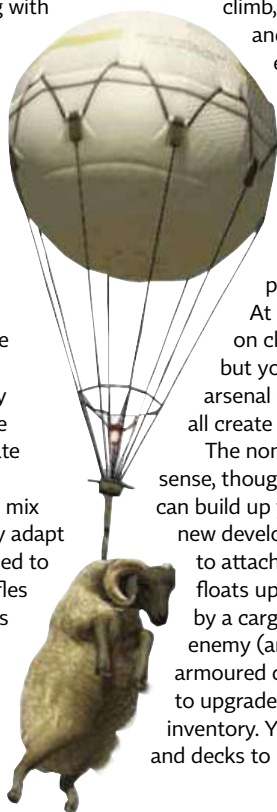
LEYTON DISORIENT

Fans of the Metal Gear Solid series can expect a highly convoluted story filled with intrigue, double-crossing and larger-than-life characters. The prologue is meant to disorientate even the most ardent Metal Gear fans, but quickly becomes inconsistent. Fans hoping the Phantom Pain would neatly resolve what happened between the events of Peace Walker and the original MSX2 title will be disappointed. After a mostly coherent Chapter One, Chapter Two feels largely unfinished, as you're forced to re-do missions on harder difficulties, while the plot development occurs at seemingly random intervals.

The second chapter is shorter than the first and ends all too abruptly. Hideo Kojima and publisher Konami have very publicly parted ways, which raises questions as to whether the director was allowed to finish his vision for the game, or whether he was forced to make cuts in order to release it on time. Just like the game's plot, there are many questions left unanswered that will keep fans guessing for a long time to come.

Despite this, though, the Phantom Pain is an absolute joy to play. By creating the illusion of an open world, despite each mission being somewhat self-contained, and giving players the choice of how to approach each encounter, it feels more like a true stealth action game than any Metal Gear title that came before it. Whether you're familiar with the series or not, it's an absolute must-play.

Tom Morgan



SPECIFICATIONS

AVAILABLE FORMATS PC, Xbox 360, Xbox One, PlayStation 3, PS4 • **OS SUPPORT** Windows 7, Windows 8.1 64-bit • **MINIMUM CPU** Intel 3.4GHz dual-core or better; AMD quad-core or better • **MINIMUM GPU** AMD Radeon R9 270X/Nvidia GeForce GTX 650 (2GB) or better • **MINIMUM RAM** 4GB • **HARD DISK SPACE** 28GB • **DETAILS** www.konami.jp/mgs5 • **PRODUCT CODE** 287700



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Choosing a ...

Laptop computer

01 A basic laptop costing around £300 will run everyday office, multimedia and education software, but it won't be suitable for 3D gaming. Many laptops at this price have a 15.4in screen and weigh around 2.4kg, so they're best used around the house and for occasional journeys.

02 If you want to play modern games, you'll need a laptop that has a dedicated graphics chip such as the Nvidia GeForce GTX 960M. Good gaming laptops tend to have large 17in screens and weigh around 3kg, so they're best suited to the home.

03 If you want a laptop that you can take everywhere, look for a model that weighs less than 2kg. For the best portability, look for one with an 11in or 13in screen. In general, the smaller and lighter the laptop, the more expensive it is, especially if you want a model with plenty of processing power.

04 Battery life is extremely important for a laptop. We'd expect all but the biggest and heaviest to last for at least five hours on a single charge, but for an ultra-portable that you carry everywhere, eight hours and above is more desirable.

05 Laptops use the mobile versions of processors to conserve power, and these lag behind desktop chips for performance. For a budget laptop, an Intel Core i3 processor will do the job, but if you want better performance, look for an Intel Core i5 or Core i7 model instead. We recommend a minimum of 4GB of RAM, although 8GB is better for multitasking.

06 Most budget and mid-range laptops have a regular hard disk for storage. You want at least 500GB, but 1TB or more is better. SSDs have faster performance, making your computer much quicker to boot. SSD capacity is lower, though, and you'll need at least 128GB.

07 Netbooks are a type of small, low-cost ultra-portable laptop. They're fine for light use, but avoid them if you want to do complicated tasks.

PCs



CHILLBLAST Fusion Wolf



£1,800 inc VAT • www.chillblast.com

One of the most powerful all-round PCs we've seen, the Fusion Wolf will blast through any game you throw at it at Ultra HD resolutions, and its overclocked processor will ease its way through any multimedia task.

PROCESSOR Quad-core 4.4GHz Intel Core i7-4790K (overclocked) • **RAM** 16GB • **FRONT USB PORTS** 2x USB3 • **REAR USB PORTS** 4x USB2, 4x USB3 • **TOTAL STORAGE** 256GB SSD, 2TB hybrid hard disk (8GB SSD cache) • **GRAPHICS CARD** 6GB Nvidia GeForce GTX 980 Ti • **DISPLAY** None • **OPERATING SYSTEM** Windows 10 • **WARRANTY** Two years collect and return with parts, three years labour-only RTB • **DETAILS** www.chillblast.com • **PART CODE** Fusion Wolf • **FULL REVIEW** Sep 2015



ACER Revvo One RL85



£350 inc VAT • www.pcworld.co.uk

One of the cleverest PC designs we've seen in ages, the tiny Acer Revvo One has enough space for three high-capacity hard disks, making it a perfect living-room PC. With an Intel Core i3 processor, it's no slouch either, and the price is as attractive as the chassis.

PROCESSOR Dual-core 1.7GHz Intel Core i3-4005U • **RAM** 4GB • **FRONT USB PORTS** 0 • **REAR USB PORTS** 2x USB2, 2x USB3 • **TOTAL STORAGE** 2TB hard disk • **GRAPHICS CARD** Integrated Intel HD 4000 graphics • **OPERATING SYSTEM** Windows 10 • **WARRANTY** One year RTB • **DETAILS** www.acer.co.uk • **PART CODE** DT.SZMEK.014 • **FULL REVIEW** Aug 2015



SCAN 3XS Z170 Performance GTK6



£1,000 inc VAT • www.scan.co.uk/3xs

Scan's first Intel Skylake-powered PC is an incredibly powerful system that can cope with just about any desktop task, and can handle gaming at 2,560x1,440 thanks to an Nvidia GeForce GTX 970 graphics card. The Z170 motherboard makes it future-proof too, with USB3.1 and an M.2 slot for PCI-Express storage.

PROCESSOR Quad-core 4.6GHz Intel Core i5-6600K (overclocked) • **RAM** 8GB • **FRONT USB PORTS** 4x USB3 • **REAR USB PORTS** 2x USB3.1, 1x USB Type-C, 2 x USB2 • **TOTAL STORAGE** 256GB SSD, 1TB hard disk • **GRAPHICS CARD** 4GB Nvidia GeForce GTX 970 • **DISPLAY** None • **OPERATING SYSTEM** Windows 10 • **WARRANTY** Three years parts cover: first year onsite, years two and three RTB • **DETAILS** www.scan.co.uk/3xs • **PART CODE** Performance Z170 GTK6 • **FULL REVIEW** Nov 2015



LAPTOPS



ASUS ZenBook UX305



£592 inc VAT • www.nigelochara.com

The UX305 is Asus's first laptop that runs Intel's new low-power Core M processors. Weighing just 1.2kg and 12mm thick, it's one of the thinnest and lightest laptops we've ever tested. Its performance won't set the world alight, but if you're after a portable work machine, look no further.

PROCESSOR Dual-core 800MHz Intel Core M-5Y10c • **RAM** 8GB • **DIMENSIONS** 324x226x12mm • **WEIGHT** 1.2kg • **SCREEN SIZE** 13.3in • **SCREEN RESOLUTION** 1,920x1,080 • **GRAPHICS ADAPTOR** Intel HD 5300 • **TOTAL STORAGE** 128GB SSD • **OPERATING SYSTEM** Windows 8.1 • **PARTS AND LABOUR WARRANTY** One year collect and return • **DETAILS** www.asus.com • **PART CODE** UX305FA(MS)-FC061H • **FULL REVIEW** Jun 2015



SCAN 3XS Graphite LG157



£918 inc VAT • www.scan.co.uk/3xs

Scan has created a successful follow-up to its Graphite LG156 with an excellent screen and build quality improvements. You also get a generous two-year warranty, making the Graphite LG157 a great choice.

PROCESSOR Quad-core 2.5GHz Intel Core i7-4710HQ • **RAM** 8GB • **DIMENSIONS** 385x268x29mm • **WEIGHT** 2.5kg • **SCREEN SIZE** 15.6in • **SCREEN RESOLUTION** 1,920x1,080 • **GRAPHICS ADAPTOR** Nvidia GeForce GTX 960M • **TOTAL STORAGE** 120GB SSD, 1TB hard disk • **OPERATING SYSTEM** Windows 10 • **PARTS AND LABOUR WARRANTY** Two years RTB • **DETAILS** www.scan.co.uk/3xs • **PART CODE** 3XS Graphite LG157 • **FULL REVIEW** Aug 2015



TOSHIBA Chromebook 2 (CB30-B-104)



£249 inc VAT • www.staples.co.uk

Toshiba's Chromebook 2 is the first budget Chromebook on sale in the UK with a Full HD screen. This increases the price a little but we think it's absolutely worth it. With so much extra real estate, you can fit more items on the screen and get more done. The machine is lighter and has better battery life than its predecessor, too, making it our current favourite Chromebook.

PROCESSOR Dual-core 2.16GHz Intel Celeron N2840 • **RAM** 4GB • **DIMENSIONS** 320x214x19mm • **WEIGHT** 1.35kg • **SCREEN SIZE** 13.3in • **SCREEN RESOLUTION** 1,920x1,080 • **GRAPHICS ADAPTOR** Intel HD Graphics • **TOTAL STORAGE** 16GB SSD • **OPERATING SYSTEM** Google Chrome OS • **PARTS AND LABOUR WARRANTY** One year RTB • **DETAILS** www.toshiba.co.uk • **PART CODE** PLMOZE-00D003EN • **FULL REVIEW** May 2015



SMARTPHONES



SAMSUNG Galaxy S6

★★★★★

£409 SIM-free, free on £32.50-per-month contract • www.handtec.co.uk (SIM-free), www.carphonewarehouse.com (contract)

The all-metal Galaxy S6 is one of Samsung's best phones yet. Its performance is among the best we've seen and its 2,560x1,440 screen looks gorgeous. If you want a phone to really turn heads, though, there's also the curvy Galaxy S6 Edge.

PROCESSOR Quad-core 1.4GHz 8 quad-core 1.5GHz Samsung Exynos 7420 • SCREEN SIZE 5.1in • SCREEN RESOLUTION 2,560x1,440 • REAR CAMERA 16 megapixels • STORAGE 32GB • WIRELESS DATA 4G • DIMENSIONS 143x70x6.8mm • WEIGHT 132g • OPERATING SYSTEM Android 5.0 • WARRANTY One year RTB • DETAILS www.samsung.co.uk • PART CODE SM-G920F • FULL REVIEW Jul 2015



APPLE iPhone 6

★★★★★

£459 SIM-free, free on £32-per-month contract • store.apple.com/uk (SIM-free), www.carphonewarehouse.com (contract)

A larger screen, faster processor and improved battery life make the iPhone 6 a huge improvement over the iPhone 5s, and it's now even cheaper as Apple makes way for the new iPhone 6s.

PROCESSOR Dual-core 1.4GHz Apple A8 • SCREEN SIZE 4.7in • SCREEN RESOLUTION 1,334x750 • REAR CAMERA 8 megapixels • STORAGE 16GB • WIRELESS DATA 4G • DIMENSIONS 138x67x6.9mm • WEIGHT 129g • OPERATING SYSTEM iOS 9 • WARRANTY One year RTB • DETAILS www.apple.com/uk • PART CODE iPhone 6 • FULL REVIEW Dec 2014



SONY Xperia Z3 Compact

★★★★★

£330 SIM-free, £80 on £17-per-month contract • www.carphonewarehouse.com (SIM-free and contract)

With its incredible 20-hour battery life and fast performance, the Sony Xperia Z3 Compact brings flagship features to a smaller handset at a great price.

PROCESSOR Quad-core 2.5GHz Qualcomm Snapdragon 801 • SCREEN SIZE 4.6in • SCREEN RESOLUTION 1,280x720 • REAR CAMERA 20.7 megapixels • STORAGE 16GB • WIRELESS DATA 4G • DIMENSIONS 127x65x8.6mm • WEIGHT 129g • OPERATING SYSTEM Android 4.4 • DETAILS www.sony.co.uk • PART CODE Sony D5803 • FULL REVIEW Jan 2015



MICROSOFT Lumia 640

★★★★★

£120 SIM-free, free on £9.50-per-month contract • www.argos.co.uk (SIM-free), www.idmobile.co.uk (contract)

The best budget Windows phone around. Its 5in screen is fantastic and its snappy performance punches above its price range. There's also the jumbo Lumia 640 XL if you want more battery life.

PROCESSOR Quad-core 1.2GHz Qualcomm Snapdragon 400 • SCREEN SIZE 5in • SCREEN RESOLUTION 1,280x720 • REAR CAMERA 8 megapixels • STORAGE 8GB • WIRELESS DATA 4G • DIMENSIONS 141x72x8.8mm • WEIGHT 145g • OPERATING SYSTEM Windows Phone 8.1 • DETAILS www.microsoft.com • PART CODE RM-1072 • FULL REVIEW Aug 2015



VODAFONE Smart Ultra 6

★★★★★

£99 pay-as-you-go, free on £17-per-month contract • shop.vodafone.co.uk (PAYG and contract)

The Vodafone Smart Ultra 6 is a mid-range smartphone at an entry-level price. Packed with an octa-core processor, a huge Full HD display and a great camera, the Smart Ultra 6 is unbelievably good value.

PROCESSOR Octa-core 1.7GHz Qualcomm Snapdragon 615 • SCREEN SIZE 5.5in • SCREEN RESOLUTION 1,920x1,080 • REAR CAMERA 13 megapixels • STORAGE 16GB • WIRELESS DATA 3G, 4G • DIMENSIONS 154x77x8.4mm • WEIGHT 159g • OPERATING SYSTEM Android 5.0.2 • WARRANTY One year RTB • DETAILS www.vodafone.co.uk • PART CODE Smart Ultra 6 • FULL REVIEW Nov 2015



TABLETS



SONY Xperia Z4 Tablet

★★★★★

£499 inc VAT • www.johnlewis.com

It's expensive, but the Z4 Tablet is a stunning bit of kit. It weighs just 389g, so is lighter than the iPad Air 2, and is an amazing 6.1mm thick. Its super-high-resolution screen has the best colour accuracy we've seen from an LCD panel, it runs Android 5 beautifully and has the best battery life we've ever seen from a tablet.

PROCESSOR Octa-core 2.3GHz Qualcomm Snapdragon 810 • SCREEN SIZE 10.1in • SCREEN RESOLUTION 2,560x1,600 • REAR CAMERA 8.1 megapixels • STORAGE 32GB • WIRELESS DATA 4G (optional) • DIMENSIONS 167x254x6.1mm • WEIGHT 389g • OPERATING SYSTEM Android 5 • WARRANTY One year RTB • DETAILS www.sonymobile.com • PART CODE Xperia Z4 Tablet • FULL REVIEW Aug 2015



GOOGLE Nexus 9

★★★★★

£200 inc VAT • www.argos.co.uk

The Nexus 9 is the first Google-branded tablet to have an iPad-style 4:3 ratio screen, which we think is a better shape for web browsing. Android 5.0 Lollipop runs beautifully and its battery life is superb.

PROCESSOR Dual-core 2.3GHz 64-bit Nvidia Tegra K1 Denver • SCREEN SIZE 8.9in • SCREEN RESOLUTION 2,048x1,536 • REAR CAMERA 8 megapixels • STORAGE 16GB • WIRELESS DATA 4G (optional) • DIMENSIONS 154x228x8.8mm • WEIGHT 425g • OPERATING SYSTEM Android 5.0 • WARRANTY One year RTB • PART CODE Nexus 9 • DETAILS www.google.com/nexus/9 • FULL REVIEW Aug 2015



APPLE iPad Air 2

★★★★★

£399 inc VAT • store.apple.com/uk

The iPad Air 2 is even thinner and lighter than its predecessor and still feels beautifully made. It's the fastest iPad yet, and now has TouchID fingerprint recognition for added security.

PROCESSOR Tri-core 1.5GHz Apple A8X • SCREEN SIZE 9.7in • SCREEN RESOLUTION 2,048x1,536 • REAR CAMERA 8 megapixels • STORAGE 16GB • WIRELESS DATA 4G (optional) • DIMENSIONS 240x170x6.1mm • WEIGHT 425g • OPERATING SYSTEM iOS 9 • WARRANTY One year RTB • DETAILS www.apple.com/uk • FULL REVIEW Aug 2015



MICROSOFT Surface 3

★★★★★

£499 inc VAT • www.microsoftstore.com

If you're after a Windows tablet but the £600-plus Surface Pro 3 is too much for you, the Surface 3 is the model to get. It's beautifully made with a great screen, and if you add the optional Type Cover keyboard you'll have a super-light laptop for working on the move.

PROCESSOR Quad-core 1.6GHz Intel Atom X7-28700 • SCREEN SIZE 10.8in • SCREEN RESOLUTION 1,920x1,280 • REAR CAMERA 8 megapixels • STORAGE 128GB • WIRELESS DATA 4G (coming soon) • DIMENSIONS 187x267x8.7mm • WEIGHT 622g • OPERATING SYSTEM Windows 10 • WARRANTY One year RTB • DETAILS www.microsoft.com • PART CODE Surface 3 • FULL REVIEW Aug 2015



TESCO Hudl 2

★★★★★

£99 inc VAT • www.tesco.com/direct/hudl

The Hudl 2 is even better value than the original. It has a great screen, good build quality and runs Android smoothly. Battery life isn't great, but otherwise this is a fantastic complete budget tablet.

PROCESSOR Quad-core 1.33GHz Intel Atom Z3730 • SCREEN SIZE 8.3in • SCREEN RESOLUTION 1,920x1,200 • REAR CAMERA 5 megapixels • STORAGE 16GB • WIRELESS DATA None • DIMENSIONS 224x128x9.9mm • WEIGHT 410g • OPERATING SYSTEM Android 4.4.2 • WARRANTY One year RTB • PART CODE hudl2 • DETAILS www.tesco.com/direct/hudl • FULL REVIEW Aug 2015



Choosing a ... Smartphone

01 A smartphone's operating system (OS) dictates its basic features and which third-party software you can install. There are three main contenders: Apple's iOS, which is found on the iPhone; Google's Android, which is used by various handset manufacturers; and Windows Phone 8, which is mainly used on Lumia phones and is a great alternative to Apple's and Google's operating systems. Apple iOS and Google Android have the most apps available but Windows Phone is slowly catching up.

02 All smartphones have colour screens, but their resolutions vary. Basic models have 800x480 pixels, but text can be indistinct. Look for a display that has at least 1,280x720 pixels so it's easy to browse web pages. Don't worry too much about built-in media players or Office document editors – you can always install apps to replace these with better versions later.

Cameras are improving in smartphones, and resolutions have increased to as high as 20 megapixels. The image quality of smartphone cameras has improved tremendously in recent years.

03 Barely any modern smartphones have a physical keyboard for entering text: they almost exclusively use touchscreens. Physical keyboards can aid heavy emailing, but touchscreen keyboards work just as well now.

Android smartphones and iPhones running iOS 9 let you install a variety of custom onscreen keyboards so you can find one that suits you.

04 Be careful when choosing a mobile contract. Look for one with a large data allowance if you want to use the internet regularly or you've set your phone to synchronise your contacts, calendar and email through online services such as Google's.

Built-in Wi-Fi can help you avoid high data charges by connecting to the internet through wireless hotspots when you're out, or your router when you're at home. Android and iPhone handsets can operate as wireless hotspots, enabling you to connect your laptop to the web over your mobile data connection. There may be an extra charge for this.

Choosing a ...

Compact system camera

01 If you're ready to step beyond the basic controls of a compact camera, or you want greater flexibility than an ultra-zoom can offer, a Compact System Camera (CSC) is the next logical upgrade. With interchangeable lenses, manual controls and stellar image quality, these cameras can give fully fledged digital SLRs a run for their money.

02 There are three competing types of CSC mount, and the one you buy determines the number of compatible lenses and accessories you have available. Samsung's NX-mount is arguably the most limited in terms of lens selection, although the range is growing. Sony's E-Mount has a slightly wider range, but Micro Four Thirds offers the widest variety. Both Panasonic and Olympus cameras use this mount, and the lenses are interchangeable between manufacturers.

03 Micro Four Thirds cameras are typically more compact than other types of CSC because the image sensor is physically smaller – with a 22mm diagonal, it's roughly 30 per cent smaller than an APS-C sensor. The APS-C sensors that Sony and Samsung use in their CSCs are the same size as those in traditional digital SLRs.

04 Like digital SLRs, CSCs come with a wide range of prices. Available from as little as £200, there's a CSC to suit every budget. Most come with at least one kit lens, but if you already have lenses for a particular CSC mount, you can buy the body on its own and save money.

05 Once you've settled on a particular mount, you should pay attention to features. Articulating screens and integrated viewfinders will help you compose shots, while extra physical controls and a hotshoe mount will give you flexibility for manual shooting. Touchscreens are great, but they're no replacement for physical dials when it comes to changing shutter speed and aperture. An integrated flash is much more convenient than a detachable one, as you can never forget to bring it with you.

PHOTOGRAPHY

COMPACT SYSTEM CAMERA

COMPUTER SHOPPER
RECOMMENDED

SAMSUNG NX3000

£240 inc VAT • www.morecomputers.com

With its high image quality, wealth of features and slim design, the NX3000 is an excellent camera. Prices can drop to around £200, but even at this price it's a bargain. Buy one while you can.

SENSOR RESOLUTION 20 megapixels • SENSOR SIZE 23.5x15.7mm (APS-C) • FOCAL LENGTH MULTIPLIER 1.5x • VIEWFINDER None • LCD SCREEN 3in (460,800 dots) • OPTICAL ZOOM (35mm-EQUIVALENT FOCAL LENGTHS) 3.1x (24-75mm) • 35mm-EQUIVALENT APERTURE f/5.2-8.4 • LENS MOUNT Samsung NX • WEIGHT 386g • DIMENSIONS 67x126x78mm • WARRANTY One year RTB • DETAILS www.samsung.com/uk • FULL REVIEW Jan 2015



COMPACT CAMERA

COMPUTER SHOPPER
BEST BUY

NIKON Coolpix S9700

£150 inc VAT • www.buyacamera.co.uk

This compact camera packs in a 30x zoom lens, Wi-Fi, GPS and slow-motion video. Its has a comprehensive set of controls, but it's the image quality that really impresses, achieving decent shots in tough conditions.

SENSOR RESOLUTION 16 megapixels • SENSOR SIZE 1/2.3in • VIEWFINDER None • LCD SCREEN 3in (921,000 dots) • OPTICAL ZOOM (35mm-EQUIVALENT FOCAL LENGTHS) 30x (25-750mm) • 35mm-EQUIVALENT APERTURE f/21-36 • WEIGHT 235g • DIMENSIONS 66x110x34mm • WARRANTY Two years RTB • DETAILS www.nikon.co.uk • FULL REVIEW Nov 2014



ULTRA-ZOOM CAMERA

COMPUTER SHOPPER
BEST BUY

PANASONIC Lumix DMC-FZ200

£309 inc VAT • www.johnlewis.com

This ultra-zoom camera has a big 25-600mm zoom range and maintains a fast F2.8 aperture across the whole focal range, so you can shoot in low-light conditions without too much worry.

SENSOR RESOLUTION 12.1 megapixels • SENSOR SIZE 6.2x4.6mm (1/2.3in) • VIEWFINDER Electronic • LCD SCREEN 3in • OPTICAL ZOOM (35mm-EQUIVALENT FOCAL LENGTHS) 24x (25-600mm) • 35mm-EQUIVALENT APERTURE f/5.6-9 • WEIGHT 588g • DIMENSIONS 87x125x110mm • WARRANTY One year RTB • DETAILS www.panasonic.com/uk • FULL REVIEW Feb 2013



CONSUMER SLR

COMPUTER SHOPPER
BEST BUY

CANON EOS 750D

£562 inc VAT (with 18-55mm kit lens) • www.jessops.com

The 750D is the new mainstay of Canon's SLR line-up. Better autofocus, D5500-beating image quality and decent video too: this is the mid-range SLR to buy. Also comes with extra manual controls as the 760D.

SENSOR RESOLUTION 24 megapixels • SENSOR SIZE 22.3x14.9mm (APS-C) • FOCAL LENGTH MULTIPLIER 1.6x • VIEWFINDER Optical • LCD SCREEN 3in • OPTICAL ZOOM (35mm-EQUIVALENT FOCAL LENGTHS) 3x (29-88mm) • 35mm-EQUIVALENT APERTURE f/5.6-9 • LENS MOUNT Canon EF-S • WEIGHT 771g • DIMENSIONS 104x132x148mm • WARRANTY One year RTB • DETAILS www.canon.co.uk • FULL REVIEW Oct 2015



COMPACT CAMERA

COMPUTER SHOPPER
BEST BUY

CANON PowerShot G7 X

£356 inc VAT • www.wexphotographic.com

With near SLR-quality stills in a truly pocketable package, the PowerShot G7 X is a huge step up from most other compact cameras - and at an excellent price.

SENSOR RESOLUTION 20 megapixels • SENSOR SIZE 1in • VIEWFINDER None • LCD SCREEN 3in (1,040,000 dots) • OPTICAL ZOOM (35mm-EQUIVALENT FOCAL LENGTHS) 4.2x (24-100mm) • 35mm-EQUIVALENT APERTURE f/4.9-7.6 • WEIGHT 303g • DIMENSIONS 64x107x40mm • WARRANTY One year RTB • DETAILS www.canon.co.uk • FULL REVIEW May 2015



DISPLAYS

MONITOR

COMPUTER SHOPPER
BEST BUY

BENQ GW2765HT

£275 inc VAT • www.cclonline.com

This 27in 2,560x1,440 IPS monitor is one of the best-value screens we've ever seen. With near-perfect sRGB colour accuracy out of the box, it's a steal for less than £300.

SCREEN SIZE 27in • RESOLUTION 2,560x1,440 • SCREEN TECHNOLOGY IPS • VIDEO INPUTS VGA, DVI, HDMI, DisplayPort • WARRANTY Two years onsite • PART CODE GW2765HT • DETAILS www.benq.co.uk • FULL REVIEW Jan 2015



MONITOR

COMPUTER SHOPPER
RECOMMENDED

VIEWSONIC VX2363Smhl-W

£129 inc VAT • www.dabs.com

The 23in VX2363Smhl-W stands out from the crowd with its white stand, IPS screen and great overall image quality. It's a good budget buy for those who have modest needs.

SCREEN SIZE 23in • RESOLUTION 1,920x1,080 • SCREEN TECHNOLOGY IPS • VIDEO INPUTS VGA, DVI, HDMI, MHL-compatible HDMI • WARRANTY Two years collect and return • PART CODE VX2363Smhl-W • DETAILS www.viewsoniceurope.com • FULL REVIEW Jan 2015



MONITOR

COMPUTER SHOPPER
BEST BUY

IYYAMA ProLite GB2488HSU-B1

£205 inc VAT • www.box.co.uk

Gamers need look no further than the Iiyama ProLite GB2488HSU-B1. It's a no-nonsense Full HD panel with a 144Hz refresh rate for lightning-fast games.

SCREEN SIZE 24in • RESOLUTION 1,920x1,080 • SCREEN TECHNOLOGY TN • VIDEO INPUTS 2x HDMI, DVI, DisplayPort • WARRANTY Two years onsite • PART CODE ProLite GB2488HSU-B1 • DETAILS www.iiyama.com • FULL REVIEW Aug 2014



MONITOR

COMPUTER SHOPPER
BEST BUY

ASUS PB279Q

£535 inc VAT • www.lambdtek.com

If you're remotely serious about design, photography or gaming and want an Ultra HD screen, this is the monitor to choose. It's plain to look at and has no USB hub, but in terms of pure image quality, nothing beats it at this price.

SCREEN SIZE 27in • RESOLUTION 3,840x2,160 • SCREEN TECHNOLOGY AHVA • REFRESH RATE 60Hz • VIDEO INPUTS 4x HDMI, DisplayPort, Mini DisplayPort • WARRANTY Three years RTB • DETAILS www.asus.com • FULL REVIEW Apr 2015



MONITOR

COMPUTER SHOPPER
BEST BUY

SAMSUNG S32D850T

£413 inc VAT • www.laptopdirect.co.uk

It's not cheap, but this 32in monitor is great value. Images are sharp and vibrant on its 2,560x1,440 panel, and the stand is among the most attractive we've seen.

SCREEN SIZE 32in • RESOLUTION 2,560x1,440 • SCREEN TECHNOLOGY VA • VIDEO INPUTS HDMI, DVI, DisplayPort • WARRANTY Two years collect and return • PART CODE S32D850T • DETAILS www.samsung.com/uk • FULL REVIEW Jan 2015



HOME CINEMA

COMPUTER SHOPPER LG 47LB730V

BEST BUY ★★★★★

£570 inc VAT • www.nigelohara.com

The LG 47LB730V has one of the best screens and smart TV interfaces we've seen. With its fantastic design and great picture quality straight out of the box, the 47LB730V is great value.

SCREEN SIZE 47in • NATIVE RESOLUTION 1,920x1,080 • VIDEO INPUTS 3x HDMI, SCART, component, composite • TUNER Freeview HD • DIMENSIONS 1,061x666x227mm • WARRANTY Five years RTB • DETAILS www.lg.com/uk • PART CODE 47LB730V • FULL REVIEW Mar 2015



COMPUTER SHOPPER FINLUX 48FT3E242S-T

RECOMMENDED ★★★★★

£350 inc VAT • finlux.co.uk

If you're after an ultra-cheap second TV, this might be right up your street. It lacks a few catch-up and on-demand services, so you might need to extend this with a cheap set-top box. For a 48in TV, it's a cracking bargain.

SCREEN SIZE 48in • NATIVE RESOLUTION 1,920x1,080 • VIDEO INPUTS 3x HDMI, SCART, VGA composite • TUNER Freeview HD • DIMENSIONS 1,084x220x720mm • WARRANTY One year RTB • DETAILS www.finlux.co.uk • PART CODE 48FT3E242S-T • FULL REVIEW Jul 2015



COMPUTER SHOPPER SAMSUNG BD-J7500

RECOMMENDED ★★★★★

£146 inc VAT • www.morecomputers.com

4K-upscaling, fantastic image quality and a wealth of streaming service support makes the BD-J7500 so much more than just a Blu-ray player.

BLU-RAY PROFILE 5.0 • 3D CAPABLE Yes • DIMENSIONS 360x224x39mm • NETWORKING Ethernet, 802.11ac Wi-Fi • WARRANTY One year RTB • DETAILS www.samsung.com/uk • PART CODE BD-J7500 • FULL REVIEW Nov 2015



COMPUTER SHOPPER LG LHB725

RECOMMENDED ★★★★★

£399 inc VAT • www.johnlewis.com

A 3D-capable home cinema surround system with a Blu-ray player that has fantastic image quality and speakers that deliver powerful sound, all housed in an attractive package.

HDMI INPUTS/OUTPUTS 2/1 • HDMI 2.0 INPUTS/OUTPUTS 2/1 • OUTPUT RESOLUTIONS 720p, 1080p • WIRELESS SUPPORT 802.11n, Bluetooth • SPEAKER CONFIGURATION 5.1 • RMS POWER OUTPUT TOTAL 1,200W • DIMENSIONS 410x55x260mm • WARRANTY One year RTB • DETAILS www.lg.com/uk • PART CODE LHB725 • FULL REVIEW Oct 2015



COMPUTER SHOPPER SAMSUNG HW-J7500

RECOMMENDED ★★★★★

£465 inc VAT • www.applianceelectronics.co.uk

This curved 8.1 soundbar and wireless subwoofer not only looks great, but it also produces excellent sound and has plenty of ports.

SPEAKERS 8 • RMS POWER OUTPUT 320W • DOCK CONNECTOR None • NETWORKING Bluetooth 3.0 • DIMENSIONS 1,230x170x42mm (soundbar), 291x371x291mm (subwoofer) • WEIGHT 4kg (soundbar), 7.8kg (subwoofer) • WARRANTY One year RTB • DETAILS www.samsung.com/uk • PART CODE HW-J7500 • FULL REVIEW Jul 2015



AUDIO

COMPUTER SHOPPER PHILIPS Fidelio M2BT

BEST BUY ★★★★★

£165 inc VAT • www.amazon.co.uk

The Philips Fidelio M2BT are premium Bluetooth headphones that sound great, look fantastic and are supremely comfortable.

HEADPHONES TYPE On-ear Bluetooth • PLUG TYPE 3.5mm jack plug • WEIGHT 190g • CABLE LENGTH 1.2m • WARRANTY One year RTB • DETAILS www.philips.co.uk • PART CODE M2BTBK/00 • FULL REVIEW Apr 2015



COMPUTER SHOPPER RAUMFELD One S

RECOMMENDED ★★★★★

£200 inc VAT • www.raumfeld.com/uk

The One S is a great compact speaker that sounds great solo or even better as a stereo pair and has a classy design that matches its refined sound.

SPEAKERS 4 • RMS POWER OUTPUT 30W • DOCK CONNECTOR None • NETWORKING 802.11n Wi-Fi • DIMENSIONS 180x110x130mm • WEIGHT 1.4kg • STREAMING FORMATS UPnP, Mesh Network • WARRANTY One year RTB • DETAILS www.raumfeld.com/uk • PART CODE One S • FULL REVIEW Nov 2015



COMPUTER SHOPPER RAZER Leviathan

RECOMMENDED ★★★★★

£150 inc VAT • www.box.co.uk

Soundbars are usually built for TVs, but Razer's Leviathan is ideal for sliding underneath a computer monitor. It sounds great and is more than loud enough to fill a room.

SPEAKERS 4 • RMS POWER OUTPUT 30W • WEIGHT 2kg (bar), 2.3kg (subwoofer) • NETWORKING Bluetooth (SBC, aptX) • WARRANTY Two years RTB • DETAILS www.razerzone.com • PART CODE RZ05-01260100-R3G1 • FULL REVIEW Jul 2015



COMPUTER SHOPPER LOGITECH UE Megaboom

RECOMMENDED ★★★★★

£236 inc VAT • www.ballnicom.co.uk

The UE Megaboom is an intensely loud and powerful Bluetooth speaker that provides a warm and impactful sound. It's waterproof, too, so could provide some entertainment poolside or at your next barbecue.

SPEAKERS 4 • RMS POWER OUTPUT Not disclosed • DOCK CONNECTOR None • WIRELESS Bluetooth (SBC) • DIMENSIONS 83x83x226mm • WEIGHT 877g • WARRANTY Two year RTB • DETAILS www.ultimateears.com • PART CODE 984-000438 • FULL REVIEW Aug 2015



COMPUTER SHOPPER ARCAM miniBlink

RECOMMENDED ★★★★★

£100 inc VAT • www.petertyson.co.uk

Stream music from your mobile phone or tablet to your hi-fi with the petite and attractive miniBlink. This high-quality Bluetooth receiver sounds good and is delightfully simple to use.

WARRANTY Two years RTB • PART CODE miniBlink • DETAILS www.arcam.co.uk • FULL REVIEW Aug 2014



Choosing a...

TV

01 A 32in Full HD TV costs around £200 and will suit smaller living rooms. TVs look much smaller in the shop than in your home, so measure the space available before you buy.

Curved TVs are becoming more common, but bear in mind that these typically take up more floor space than a traditional flat set.

02 A 1,920x1,080-resolution TV can display a 1080p image. You can still buy TVs with a 720p (1,366x768) resolution, but they're no cheaper and the image won't be as sharp. 3,840x2,560 Ultra HD resolution, or 4K, TVs are finally available at reasonable prices, although you'll still pay a premium for one over a 1080p model.

03 Consider the number of inputs you'll need for your equipment. Two HDMI ports should be the bare minimum, but many TVs come with four. You'll need HDMI 2.0 if you want a future-proof 4K TV, as this is the only way to get 60fps video playback from external sources at such a high resolution.

If you want to plug your PC into your TV, you'll need to use either HDMI or VGA inputs. Be aware that some TVs only let you use a PC on an analogue input, and others won't display the Windows desktop at the TV's highest resolution.

04 The contrast ratio tells you the difference between the darkest and the brightest shades the screen can display. The higher the number, the darker the blacks and the brighter the whites. A screen with a high contrast ratio is more likely to show a wider range of detail.

05 HD content is now fairly widespread, but if you want Ultra HD your options are more limited. Most Ultra HD TVs have Netflix built into their smart TV systems, but only BT is providing live Ultra HD video with BT Sport Ultra HD. Ultra HD Blu-ray players are due to arrive in 2016, but in the meantime Amazon's Fire TV set-top box will stream Prime Instant Video at Ultra HD resolutions.

Choosing an ...

Internal hard disk

01 A basic 1TB internal hard disk should cost around £40. It'll be fast enough for general use and provide enough storage for most users. Make sure the hard disk you choose has the appropriate interface type for your PC. Some mechanical hard disks still come with SATA2 interfaces, but newer models and most solid-state drives (SSDs) have faster SATA3 interfaces. You'll need a motherboard with a SATA3 port if you want to benefit from SATA3's faster speeds – SATA3 disks will work with SATA2 ports but can only transfer files at SATA2 speeds.

02 SSDs can make the most of SATA3's extra bandwidth for fast file transfers. They use flash memory similar to that found in USB flash drives, and although they tend to provide less capacity than mechanical hard disks, they're significantly faster.

03 Buy a hard disk that provides more capacity than you think you need, as your storage requirements are likely to grow. A 2TB disk strikes the best balance between capacity and low cost per gigabyte, but in general you should aim to buy the largest disk you can afford.

04 If you want more disk space or you want to protect your data against disk failure, think about buying several hard disks to create a RAID array. These use multiple hard disks to create one large logical disk with better performance, or to duplicate your data for better protection. RAID arrays require hard disks of the same size. In theory, they can be from different manufacturers, but it's better to buy identical disks if you can.

05 A hard disk's spindle speed determines how quickly it can transfer data. A spindle speed of 7,200rpm is common in desktop drives and is fast enough for most purposes. Desktop hard disks with 5,400rpm spindle speeds are quite slow but use less power and generate less heat and noise.

To strike the best balance between speed and storage capacity, use an SSD as your system disk and store your files on a larger mechanical disk.

STORAGE

SSD	COMPUTER SHOPPER RECOMMENDED ★★★★★ CRUCIAL MX100 256GB £94 inc VAT • www.comwales.co.uk The MX100 is quick for a budget SSD and the price makes the 256GB model fantastic value. 128GB and 512GB models are also available if you want to save money, or need more storage. CAPACITY 256GB • COST PER GIGABYTE £0.37 • INTERFACE SATA3 • WARRANTY Three years RTB • PART CODE CT256MX100SSD1 • DETAILS uk.crucial.com • FULL REVIEW Apr 2015	
HARD DISK	COMPUTER SHOPPER BEST BUY ★★★★★ WESTERN DIGITAL Red 6TB £212 inc VAT • www.cclonline.com The Red 6TB combines excellent performance with a high capacity and special firmware, making a hard disk that's perfect for use in NAS enclosures. CAPACITY 6TB • COST PER GIGABYTE £0.03 • INTERFACE SATA3 • WARRANTY Three years RTB • PART CODE WD60EFRX • DETAILS www.wdc.com • FULL REVIEW Nov 2014	
NAS	COMPUTER SHOPPER BEST BUY ★★★★★ SYNOLOGY Diskstation DS215j £130 inc VAT • www.ebuyer.com Synology's latest NAS is faster than its predecessor thanks to an upgraded CPU, and is capable of rapid file transfers. DSM is still the best NAS operating system we've used, too. 3.5in HARD DISK BAYS (FREE) 2 (2) • NETWORKING 2x10/100/1,000 Ethernet • WARRANTY Two years RTB • PART CODE DS215J • DETAILS www.synology.com • FULL REVIEW Jun 2015	
PORTABLE SSD	COMPUTER SHOPPER BEST BUY ★★★★★ SAMSUNG T1 500GB £165 inc VAT • www.pcworld.co.uk The T1 is significantly faster than any USB3 flash drive as it has its own SSD controller. Combined with a USB3 connection, it's able to transfer files at unbelievable speeds – then slips into a pocket for taking on the move. CAPACITY 500GB • COST PER GIGABYTE £0.33 • INTERFACE USB3 • CLAIMED READ 450MB/s • CLAIMED WRITE 450MB/s • WARRANTY Three years RTB • PART CODE MU-PS500B/EU • DETAILS www.samsung.com/uk • FULL REVIEW Apr 2015	
PORTABLE HARD DISK	COMPUTER SHOPPER BEST BUY ★★★★★ TOSHIBA Canvio Connect II 2TB £74 inc VAT • www.ebuyer.com There's plenty of choice when it comes to portable hard disks, but Toshiba's Canvio Connect II has an excellent bundled software package and impressive USB3 speeds. Considering the price, there's no reason not to buy one. CAPACITY 2TB • COST PER GIGABYTE £0.04p • INTERFACE USB3 • WARRANTY One year RTB • PART CODE HDTCC820ER3CA • DETAILS www.toshiba.eu • FULL REVIEW Nov 2015	

PRINTERS AND SCANNERS

MONO LED PRINTER	COMPUTER SHOPPER BUSINESS BUY ★★★★★ RICOH SP 3600DN £193 inc VAT • www.nigelohara.com The SP 3600DN can print up to 50,000 pages per month at 30ppm. The quality is good, and each page costs only about 1.2p. It's a good choice for a busy small firm. TECHNOLOGY Mono LED • MAXIMUM PRINT RESOLUTION 1,200x1,200dpi • DIMENSIONS 268x370x392mm • WEIGHT 14.5kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY Two years RTB • DETAILS www.ricoh.co.uk • PART CODE 906231 • FULL REVIEW Oct 2015	
COLOUR LASER	COMPUTER SHOPPER BEST BUY ★★★★★ CANON i-SENSYS LBP7780Cx £413 inc VAT • www.nigelohara.com It's somewhat expensive to buy, but the Canon i-SENSYS LBP7780Cx is very cheap to run and produces impressively high-quality prints. TECHNOLOGY Single-pass colour laser • MAXIMUM PRINT RESOLUTION 600x600dpi • DIMENSIONS 408x517x530mm • WEIGHT 31kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year onsite • DETAILS www.canon.co.uk • PART CODE 6140B010AA • FULL REVIEW Mar 2015	
INK JET MFP	COMPUTER SHOPPER BEST BUY ★★★★★ EPSON Expression Photo XP-760 £125 inc VAT • www.bbox.co.uk It's not brilliant for printing office documents, but if you want great photos and fantastic scanning, Epson's good-looking and compact XP-760 is perfect. TECHNOLOGY Piezo inkjet • MAXIMUM PRINT RESOLUTION 5,760x1,440dpi • MAXIMUM OPTICAL SCAN RESOLUTION (OUTPUT BIT DEPTH) 2,400x4,800dpi (48-bit) • DIMENSIONS 141x390x341mm • WEIGHT 6.9kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year RTB • DETAILS www.epson.co.uk • PART CODE C11CD96401 • FULL REVIEW Mar 2015	
INK JET MFP	COMPUTER SHOPPER BEST BUY ★★★★★ CANON Pixma MG6650 £78 inc VAT • www.amazon.co.uk This well-specified MFP isn't the fastest, but its print, copy and scan quality are superb. Improved touchscreen controls make it easier to use than some Pixmas, and its ink costs are reasonable too. TECHNOLOGY Thermal inkjet • MAXIMUM PRINT RESOLUTION 4,800x1,200dpi • SCANNER RESOLUTION 1,200x1,200dpi • DIMENSIONS 148x455x369mm • WEIGHT 6.4kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year RTB • DETAILS www.canon.co.uk • PART CODE 9539B008AA • FULL REVIEW Aug 2015	
OFFICE PRINTER	COMPUTER SHOPPER BEST BUY ★★★★★ HP Officejet Pro X476dw £325 inc VAT • www.ebuyer.com It may be an inkjet, but HP's MFP beats many colour lasers in terms of speed, print quality and running costs. TECHNOLOGY Thermal inkjet • MAXIMUM PRINT RESOLUTION 2,400x1,200dpi • SCANNER RESOLUTION 1,200x1,200dpi • DIMENSIONS 517x517x399mm • WEIGHT 24kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year onsite • DETAILS www.hp.co.uk • PART CODE CN461A • FULL REVIEW Mar 2015	

NETWORKS

COMPUTER SHOPPER
BEST BUY

TP-LINK Archer C9

★★★★★

£100 inc VAT • www.currys.co.uk

It doesn't have a modem, so you'll need to pair it with your ISP's cable, ADSL or fibre modem, but the Archer C9 is an incredibly capable router with plenty of features and fantastic wireless performance.

WI-FI STANDARD 802.11ac • STATED SPEED 1,900Mbit/s • USB PORTS 1x USB3, 1x USB2 • LAN PORTS 4x Gigabit • WALL MOUNTABLE No • WARRANTY Three years RTB • PART CODE Archer C9 • DETAILS uk.tp-link.com • FULL REVIEW Sep 2015



COMPUTER SHOPPER
RECOMMENDED

BT Dual-Band Wi-Fi Extender 1200

★★★★★

£50 inc VAT • www.shop.bt.com

This fast wireless extender is easy to set up and is the perfect companion to an 802.11ac router. The wired LAN port lets you connect a wired device to your wireless network, too.

WI-FI STANDARD 802.11ac • STATED SPEED 867Mbit/s • LAN PORTS 1x 10/100 • WARRANTY Three years RTB • PART CODE 80462 • DETAILS connectedhome.bt.com • FULL REVIEW Aug 2015



COMPUTER SHOPPER
RECOMMENDED

DEVELO dLAN 1200+ Starter Kit

★★★★★

£110 inc VAT • www.scan.co.uk

Devol's dLAN 1200+ is the fastest Powerline networking kit we've seen, even if you're limited to a single Gigabit Ethernet connection. The passthrough sockets are very convenient, too.

POWERLINE NETWORKING STANDARD HomePlug AV2 • STATED SPEED 1,200Mbit/s • ADAPTORS IN BOX 2 • WARRANTY Three years RTB • PART CODE 09378 • DETAILS www.devolo.com/uk • FULL REVIEW Feb 2015



COMPUTER SHOPPER
RECOMMENDED

ASUS EA-AC87

★★★★★

£119 inc VAT • www.cclonline.com

It's much larger than the average range extender, but that's only to make room for a whopping five Gigabit Ethernet ports. The EA-AC87 can also act as a Wi-Fi access point.

MODEM None • WI-FI STANDARD 802.11ac • STATED SPEED 1,734Mbit/s • USB PORTS 1x USB3, 1x USB2 • LAN PORTS 5x Gigabit • WARRANTY Two years RTB • PART CODE 90IG01A0-BU9000 • DETAILS www.asus.com • FULL REVIEW Sep 2015



D-LINK DSL-3590L

★★★★★

£154 inc VAT • www.dabs.com

If you want to ditch your ISP-provided modem router, D-Link's DSL-3590L should be your first choice. It might not have the fastest Wi-Fi speeds but the feature list is impeccable.

MODEM ADSL2+ • WI-FI STANDARD 802.11ac • STATED SPEED 1,900Mbit/s • USB PORTS 1x USB3, 1x USB2 • LAN PORTS 4x Gigabit • WALL MOUNTABLE No • WARRANTY Two years RTB • PART CODE DSL-3590 • DETAILS www.dlink.com • FULL REVIEW Sep 2015



VIDEO

COMPUTER SHOPPER
RECOMMENDED

AMAZON Fire TV Stick

★★★★★

£35 inc VAT • www.amazon.co.uk

The Amazon Fire TV Stick is a great inexpensive media-streaming device, which excels if you're an Amazon Prime subscriber. Even if you're not, you'll still get good mileage out of the Fire TV Stick through other platforms such as Plex. It's our new favourite discrete streaming device.

VIDEO OUTPUTS HDMI 1.4 • NETWORKING 802.11n • STREAMING FORMATS UPnP, AirPlay, DLNA • INTERNET STREAMING SERVICES iPlayer, Netflix, Sky News, Spotify, TuneIn Radio, Amazon Instant Video, TVPlayer • DIMENSIONS 115x15x17mm • WARRANTY One year RTB • PART CODE Fire TV Stick • DETAILS www.amazon.co.uk • FULL REVIEW Aug 2015



COMPUTER SHOPPER
RECOMMENDED

GOPRO Hero4 Black

★★★★★

£275 inc VAT • www.simplyelectronics.net

The GoPro Hero4 Black doesn't deviate from the existing GoPro template but is an excellent action camera that introduces stunning 4K video at 30fps. You also get support for a wide range of mounts and accessories, meaning you'll be able to capture fantastic footage whatever the activity.

SENSOR 1/2.3in CMOS • SENSOR PIXELS 12,000,000 • MAX RECORDING RESOLUTION 4K (30fps) • AV CONNECTIONS Micro HDMI output, 3.5mm microphone to Mini USB (optional) • DIMENSIONS 41x59x30mm • WEIGHT 89g (152g with housing) • WARRANTY One year RTB • PART CODE CHDHX-4-1-EU • DETAILS www.gopro.com • FULL REVIEW May 2015



COMPUTER SHOPPER
BEST BUY

CANON Legria HF G30

★★★★★

£841 inc VAT • www.nigelohara.com

This fantastic enthusiast camcorder has a capacitive touchscreen monitor, a great electronic viewfinder and a sensible array of function buttons. Its image quality is excellent, too.

OPTICAL ZOOM 20x • SENSOR 1/2.3in CMOS • LCD SCREEN 3.1in LCD, 1,230,000 dots • DIMENSIONS 84x189x182mm • WEIGHT 900g • WARRANTY One year RTB • PART CODE 8454B009AA • DETAILS www.canon.co.uk • FULL REVIEW Sep 2013



COMPUTER SHOPPER
RECOMMENDED

HAUPPAUGE HD PVR Rocket

★★★★★

£126 inc VAT • www.ebuyer.com

The HD PVR Rocket lets you record your gameplay from a PC or games console, including your own commentary. It's well designed, with a large red Record button and the ability to record directly to a USB drive.

WARRANTY Two years RTB • PART CODE 1527 • DETAILS www.hauppage.co.uk • FULL REVIEW Apr 2013



COMPUTER SHOPPER
RECOMMENDED

PANASONIC HC-WX970

★★★★★

£615 inc VAT • www.photospecialist.co.uk

This twin-camera 4K-capable camcorder lets you capture 8-megapixel stills from 4K video. It has superb image stabilisation and its HDR video mode can help with exposing difficult scenes.

OPTICAL ZOOM 20x • SENSOR 1/2.3in BSI MOS • LCD SCREEN 3in, 460,800 dots • DIMENSIONS 73x65x139mm • WEIGHT 360g • WARRANTY One year RTB • DETAILS www.panasonic.com • PART CODE HC-WX970 • FULL REVIEW Sep 2013



Choosing a ...

NAS device

01 A network-attached storage (NAS) device lets you store media, documents and other files on its hard disks so that you can share them with others on your network. Some have disks already installed, while others are empty enclosures into which you install your own disks.

You should buy one with a Gigabit Ethernet interface, as these provide the highest transfer speeds. To use a NAS device at these speeds, you'll need computers with Gigabit Ethernet network adaptors and a Gigabit Ethernet switch or router. Computers with Fast Ethernet adaptors can still access the NAS device, but only at 100Mbit/s.

02 The amount of network storage you need depends on the types of files you use. If you want to store Word and Excel documents, for example, a 1TB device will be more than enough. In fact, a 1TB device will be sufficient for a family's entire media collection. Small businesses should consider higher storage capacities, depending on the nature of the business.

03 If you can see no end to your storage needs, buy an upgradable NAS device. Many have a USB port for adding an external disk. Devices such as Synology's barebones NAS kits have spare disk trays for cheaper and faster upgrades.

04 If you want extra protection for your data, look for a device that supports RAID. RAID 1 and RAID 5 arrays reduce the available capacity by duplicating data, but you won't lose it if a disk fails.

05 If you need access to your files while you're away from home or the office, look for a NAS device with an FTP server. Some can also share a USB printer across your network, saving you the expense of buying an Ethernet printer.

A NAS device with a Universal Plug and Play (UPnP) media server can stream your music, photos and videos to a network media player, so you can enjoy your media collection in another room.

Choosing a ...

Graphics card

01 You really don't have to spend much to buy a decent graphics card that can drive multiple monitors. The AMD Radeon R7 250 costs less than £60, for example, and while it isn't suited to playing the latest games in Full HD, it is perfect for watching videos, browsing the web and playing basic games.

02 You'll need to spend more money if you want to play the latest games. A good mid-range gaming graphics card is the Nvidia GTX 960, which is powerful enough to play any of the latest games.

High-powered cards tend to be more expensive, so expect to pay over £300 if you want to play games in Ultra HD at the highest quality settings.

03 Check that your chosen card has the graphics outputs you need. Only low-end cards now have VGA outputs, but many come with a DVI-to-VGA adaptor. Depending on your monitor, you may also want an HDMI output or even DisplayPort.

Bear in mind that AMD's Eyefinity triple-monitor gaming mode requires at least one DisplayPort monitor, which means your AMD graphics card must have at least one DisplayPort output. Nvidia's Surround three-monitor mode needs only DVI and HDMI ports.

04 The amount of memory a card has is important if you want games to look their best at high resolutions. Get a card with 2GB of RAM at the very least, as this should allow you to select the highest-quality textures in games.






05 A card's size, noise output and power requirements are the final considerations. Make sure your PC's case has enough room to accommodate your chosen card. Double-slot cards with large fans tend to be quieter than single-slot cards with small fans but will block other expansion slots on your motherboard.

Also check that your power supply can provide the power the card needs and that it has the right connectors. Many cards require a six-pin PCI Express power connector, and some also need an additional eight-pin connector.

COMPONENTS

GRAPHICS CARD	COMPUTER SHOPPER RECOMMENDED	MSI GTX 960 Gaming 2G ★★★★★ £161 inc VAT • www.ebuyer.com Nvidia's latest mid-range card is a fantastic performer at 1080p and will also play most titles at 1440p. It's whisper quiet too, switching its fans off completely when you aren't gaming. GPU Nvidia GeForce GTX 960 • MEMORY 2GB GDDR5 • GRAPHICS CARD LENGTH 367mm • WARRANTY Three years RTB • DETAILS www.msi.com • PART CODE GTX 960 GAMING 2G • FULL REVIEW May 2015	
	COMPUTER SHOPPER BEST BUY	INTEL Core i5-4690K ★★★★★ £180 inc VAT • www.ebuyer.com The Core i5-4690K is a redesigned variant of the Core i5-4670K and runs at a faster speed out of the box but at lower temperatures. Coupled with its unlocked multiplier, this means the chip is ideal for overclocking. SOCKET LGA1150 • CORES 4 • FREQUENCY 3.5GHz • INTEGRATED GRAPHICS Intel HD Graphics 4600 • WARRANTY One year RTB • DETAILS www.intel.com • PART CODE BX80646I54690K • FULL REVIEW May 2015	
PROCESSOR	COMPUTER SHOPPER BEST BUY	AMD A10-7700K ★★★★★ £91 inc VAT • www.scan.co.uk The A10-7700K strikes an excellent balance between desktop and graphics performance, making it the ideal all-rounder for an inexpensive PC build. SOCKET FM2 • CORES 4 • FREQUENCY 3.4GHz • INTEGRATED GRAPHICS AMD Radeon R7 • WARRANTY One year RTB • DETAILS www.amd.com • PART CODE AD770KXBJABOX • FULL REVIEW May 2015	
MOTHERBOARD	COMPUTER SHOPPER RECOMMENDED	ASUS Z97-E ★★★★★ £100 inc VAT • www.dabs.com The Asus Z97-E is well priced for an LGA1150 motherboard, and automatic overclocking helps squeeze extra performance from your CPU with minimal effort. SOCKET LGA1150 • CHIPSET Intel Z97 • MEMORY SLOTS 4 • PCI-E x16 SLOTS 2 • PCI-E x1 SLOTS 3 • PCI SLOTS 2 • USB PORTS 2x USB3, 4x USB2, 4x USB3 • VIDEO OUTPUTS HDMI, DVI, VGA • DIMENSIONS 305x218mm • WARRANTY Three years RTB • DETAILS www.asus.com • PART CODE Z97-E • FULL REVIEW May 2015	
PC CASE	COMPUTER SHOPPER RECOMMENDED	SILVERSTONE Quiet Precision PS11 ★★★★★ £37 inc VAT • www.scan.co.uk Well made and finished for the price, with plenty of sound-deadening features, the PS11 is the ideal starting point for a new PC build. The design might be a little plain, but we aren't complaining for £35. CASE TYPE ATX • MOTHERBOARD COMPATIBILITY ATX, microATX, Mini-ITX • SUPPLIED FANS 1x 120mm • MAX 3 1/2 in DRIVE BAYS 3 • MAX 5 1/2 in DRIVE BAYS 2 • DIMENSIONS 215x482x427mm • WEIGHT 4.8kg • WARRANTY One year RTB • DETAILS www.silverstonetek.com • PART CODE SST-PS11B-Q • FULL REVIEW May 2015	

SOFTWARE

VIDEO EDITING	COMPUTER SHOPPER BEST BUY	ADOBE Premiere Elements 13 ★★★★★ £79 inc VAT • www.adobe.com/uk Premiere Elements 13 offers a wealth of features to keep advanced video editors happy and has even more to help new users make the most of it. It's the best consumer video-editing package you can buy. OS SUPPORT Windows 7, 8 • MINIMUM CPU 2GHz with SSE2 • MINIMUM GPU DirectX 9 or 10 • MINIMUM RAM 2GB • HARD DISK SPACE 5GB • DETAILS www.adobe.com/uk • PRODUCT CODE 65234288 • FULL REVIEW Jan 2015	
	COMPUTER SHOPPER BEST BUY	SERIF PagePlus X8 ★★★★★ £45 inc VAT • www.serif.com Get full control over the layout and appearance of your documents, from flyers to professional-looking publications. Version 8 adds a baseline grid, making text easier to line up, and improves photo editing. OS SUPPORT Windows XP or later • MINIMUM CPU Intel Pentium 4 or later, AMD Athlon 64 or later • MINIMUM GPU Not stated • MINIMUM RAM 512MB (Windows XP), 1GB (Vista, 32-bit Windows 7/8), 2GB (64-bit Windows 7/8) • HARD DISK SPACE 510MB • DETAILS www.serif.com/pageplus • PRODUCT CODE N/A • FULL REVIEW Feb 2015	
PHOTO EDITING	COMPUTER SHOPPER RECOMMENDED	ADOBE Photoshop Elements 13 ★★★★★ £79 inc VAT • www.adobe.com/uk Elements may not have all the features of the full version of Photoshop, but it's still our favourite photo-editing package, and version 13 is the best yet, thanks to a new Guided mode for newcomers. OS SUPPORT Windows 7, 8 • MINIMUM CPU 1.6GHz with SSE2 • MINIMUM GPU DirectX 9 or 10 • MINIMUM RAM 2GB • HARD DISK SPACE 5GB • DETAILS www.adobe.com/uk • PRODUCT CODE 65237742 • FULL REVIEW Feb 2015	
GRAPHIC DESIGN	COMPUTER SHOPPER BEST BUY	SERIF Affinity Designer ★★★★★ £40 inc VAT • itunes.apple.com The first real competition to Adobe's Illustrator may be an OS X exclusive, but Affinity Designer is a seriously powerful graphic design tool that costs an incredibly reasonable £40. OS SUPPORT Apple OS X 10.7.5 • MINIMUM CPU Core 2 Duo (64-bit) • MINIMUM GPU Intel HD Graphics • MINIMUM RAM 1GB • HARD DISK SPACE 325MB • DETAILS affinity.serif.com • PRODUCT CODE Affinity Designer • FULL REVIEW Mar 2015	
MUSIC PRODUCTION	COMPUTER SHOPPER BEST BUY	STEINBERG Cubase Artist 8 ★★★★★ £220 inc VAT • www.steinberg.net Music production software usually saves the best features for the priciest version, but that's not the case here, making Cubase Artist 8 an excellent investment for musicians aspiring to the highest standards. OS SUPPORT Windows 7 or later • MINIMUM CPU Intel Core i5 dual-core • MINIMUM GPU DirectX 10 • MINIMUM RAM 4GB • HARD DISK SPACE 15GB • DETAILS www.steinberg.net • PRODUCT CODE 45550 • FULL REVIEW May 2015	

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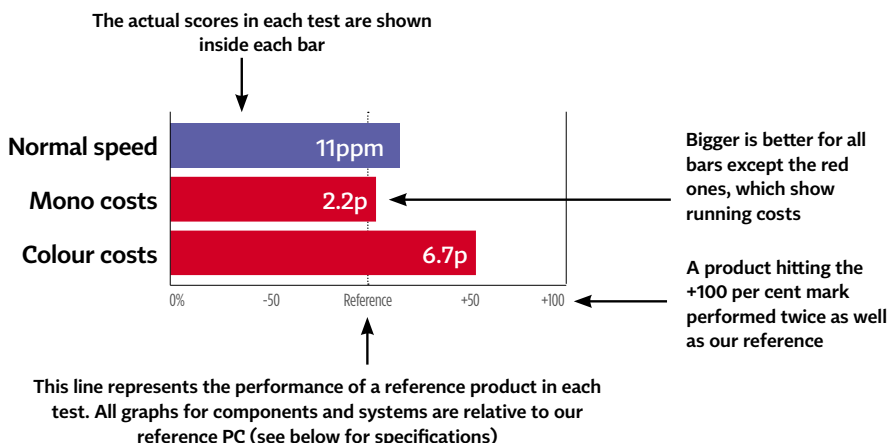
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How we test

Find out how well products perform with the help of *Computer Shopper's* comprehensive tests

COMPUTER SHOPPER'S REVIEWS use some of the most exhaustive testing procedures you'll find in any PC magazine. Every product is subjected to qualitative and quantitative tests that show how it performs in practical use. Graphs for performance, battery-life scores and costs are used in the Reviews section, as shown on the right. Look in the 'Summary of tests' box (below) for details of each test we run.

For PCs and laptops, we evaluate performance using our own custom benchmarking suite. See below for a brief description of our benchmarking software and game tests.



SUMMARY OF TESTS

PC SYSTEMS

Windows overall	Average speed across numerous demanding tasks
Multitasking	Speed when running simultaneous applications

Dirt Showdown (1080p)	Frames per second at 1,920x1,080, 4xAA, Ultra detail
Metro: Last Light Redux	Frames per second at 1,920x1,080, SSAA, Very High detail

LAPTOPS

Windows overall	Average speed across numerous demanding tasks
Multitasking	Processor-intensive multitasking test
Dirt Showdown (720p)	Frames per second at 1,280x720, 4xAA, High detail
Battery life	Run time in minutes for continuous video playback

SMARTPHONES/TABLETS

Battery life	Run time in minutes for continuous video playback
--------------	---

PRINTERS AND MFPs

Mono text speed	Pages per minute for correspondence-quality text
Mixed colour speed	Pages per minute for presentable text and graphics
Mono page cost	Running costs expressed as pence per page
Colour page cost	Running costs expressed as pence per page

DIGITAL CAMERAS

Battery life	Number of shots from full charge
--------------	----------------------------------

CAMCORDERS

Battery life	Run time in minutes for recording
--------------	-----------------------------------

MP3 PLAYERS

Battery life	Run time in minutes for continuous playback
--------------	---

ROUTERS

Laptop 24GHz 10m	Mbit/s at 10m with 802.11n laptop on 24GHz band
Laptop 24GHz 25m	Mbit/s at 25m with 802.11n laptop on 24GHz band
Laptop 5GHz 10m	Mbit/s at 10m with 802.11n laptop on 5GHz band
Laptop 5GHz 25m	Mbit/s at 25m with 802.11n laptop on 5GHz band
802.11ac adaptor 10m	Mbit/s at 10m with an 802.11ac adaptor
802.11ac adaptor 25m	Mbit/s at 25m with an 802.11ac adaptor

NETWORK-ATTACHED STORAGE

Large files	Average MB/s for read/write of 100MB large files
Small files	Average MB/s for read/write of 100MB small files

HARD DISKS

Extra large files	Average MB/s for read/write of a single 2.5GB file
Large files	Average MB/s for read/write of 2.5GB of large files
Small files	Average MB/s for read/write of 2.5GB of small files

PROCESSORS

Windows overall	Average speed across numerous demanding tasks
Multitasking	Speed when running simultaneous applications
Dirt Showdown (720p)	Frames per second at 1,280x720, 4xAA, High detail

MOTHERBOARDS

Windows overall	Average speed across numerous demanding tasks
Multitasking	Speed when running simultaneous applications
Dirt Showdown (1080p)	Frames per second at 1,920x1,080, 4xAA, Ultra detail
Dirt Showdown (720p)	Frames per second at 1,280x720, 4xAA, High detail

GRAPHICS CARDS

Dirt Showdown (1080p)	Frames per second at 1,920x1,080, 4x MSAA, Ultra detail
Tomb Raider	Frames per second at 1,920x1,080, SSAA, Ultra detail
Metro: Last Light Redux	Frames per second at 1,920x1,080, SSAA, Very High detail

BENCHMARKS

SHOPPER BENCHMARKS

Our benchmark suite uses open-source software that runs on Windows, Mac OS X and Linux systems. This lets us use objective results to compare PCs and laptops, no matter which operating system they run. It's designed to test each computer to its limit, using a combination of intensive image-editing, video-encoding and multitasking tests.

We ran the tests on our reference PC, which has an Intel Core i5-4670K processor, 8GB of DDR3 RAM and an AMD Radeon R7 260X graphics card. We normalised our results so this PC had a score of 100. This makes it easy to draw comparisons between test systems.

The resulting overall score is shown at the bottom of every PC and laptop review. As we use the same tests in our standalone and group test reviews, you can compare the performance of any computer, whether it's a netbook, laptop or desktop, from both sections of the magazine.

To see how your computer compares, you can download the suite from www.shopperdownload.co.uk/benchmarks. Versions are available for 32-bit and 64-bit operating systems.

3D BENCHMARKS

DIRT SHOWDOWN

Dirt Showdown is a cracking racing game that makes good use of DirectX 11's fancy graphical effects. You'll want at least 30fps for smooth racing.



TOMB RAIDER

With the ultra-demanding Super-Sampling Anti-Aliasing (SSAA) enabled, 2013's Tomb Raider reboot is a great indicator of mid-range performance.



METRO: LAST LIGHT REDUX

Our most demanding graphics test uses tessellation, SSAA and massive textures to give even high-end cards a thorough workout.



RATINGS & AWARDS

Computer Shopper rates products out of five:

Avoid	☆☆☆☆☆
Below average	☆☆☆☆☆
Good	☆☆☆☆☆
Very good	☆☆☆☆☆
Excellent	☆☆☆☆☆

The best products can win the following awards:

BEST BUY

Products with outstanding quality and performance for the money win our Best Buy award.



RECOMMENDED

Products that don't quite qualify for a Best Buy award but are still highly rated by our reviewers.



BUSINESS

The very best products for work win our Business Buy award.



Product Reviews

Our guide to all the products reviewed in this month's *Shopper*

104
Reviews

Lead Product 24

Motorola Moto G 3rd Gen

Handhelds 26

Nokia N1

Samsung Galaxy S6 Edge+

Samsung Galaxy Tab S2 9.7

PCs & Laptops 32

Asus ROG G751JT

Chillblast Fusion Nano Fury

DELL Inspiron Micro

Desktop

Wired2Fire Diablo Elite

Windows 10 Laptops 78

Acer Aspire R11

Acer Aspire Switch 10 E

Acer Aspire V3-574G

Asus EeeBook X205TA

Dell Inspiron 15 5000

HP Envy x360

HP Pavilion x2

Toshiba Satellite C40-C

Toshiba Satellite Click Mini

Toshiba Satellite Radius 15

Photography 36

Fujifilm X-T10

Panasonic Lumix DMC-GX8

Displays 39

BenQ EW2750ZL

Iiyama ProLite XB2481HS-B1

Home Cinema 42

Orbitsound A70 airSOUND

Philips 55PFT6510/12

Samsung UE32J6300

Audio 47

Ministry of Sound Audio S Plus

Video 48

Humax HDR-1100S

Veho Muvi K2 NPNG

Printers & Scanners 52

Canon Pixma MX495

Xerox WorkCentre 6027

Networks 53

Nest Cam

Storage 54

Toshiba Canvio AeroCast

Components 56

EVGA GTX 960 SuperSC

ACX 2.0+

MSI Radeon R9 370

Gaming 2GB

Silverstone Kublai KL05

Software 59

Corel PaintShop Pro X8

Ultimate

Xara Photo & Graphic

Designer 11

Games 62

Metal Gear Solid V:

The Phantom Pain

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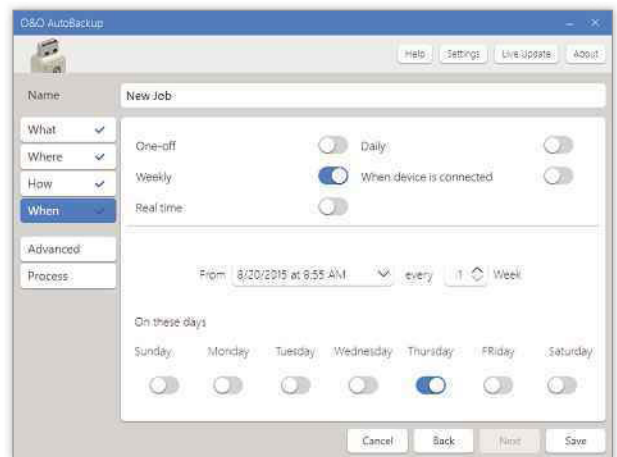
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O&O AutoBackup 4

O&O AUTOBACKUP CAN automate the process of backing up your files. This simple tool is wonderfully easy to use – something of a rarity in backup software. All you need to do is choose whether you'd like to back up a drive or a folder, then indicate which USB or hard disk drive should be used as the backup destination. Once you've done this, the program will sit quietly in the background and simply update the backup whenever the chosen drive is connected.

You can specify wildcards, so you're able to choose the types of file that are backed up. This is not only a good idea if you are only interested in backing up particular files, it's also useful if you're working with a USB drive with a limited capacity and need to focus on the most important files.

O&O AutoBackup also provides real-time synchronisation. As soon as a file is created or changed in the folders you've specified, the software



will copy it to the destination drive. A new tabbed interface makes it much easier to get started, too. Define the files to back up, the destination drive, file type and when the backup should be launched (daily, weekly, on device connection or in real time), and you're done. Simple backups really can be configured in seconds.

REQUIREMENTS Windows XP, Vista, 7 or 8 32/64-bit, 40MB hard disk space
WEBSITE www.oo-software.com
NOTES Get your registration code at

GETTING STARTED

The download instructions on the opposite page show you how to connect to the download site. Please make sure that you type in the web address exactly as shown. You'll need your coupon code the first time you log on.

ANY PROBLEMS

If you need help with any of the software this month, please send an email to letters@computersshopper.co.uk. We check this inbox regularly. Please include the issue number of the magazine and your coupon code.

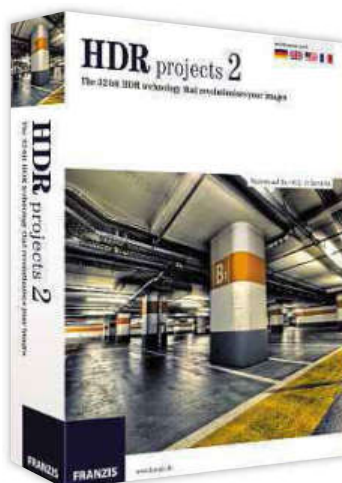
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Software manufacturers have been requiring us to use online registration for some time now, but increasingly we're being asked to provide the program as a download. In order to continue bringing you the best free software, we've revamped our download site. You need to use the unique code printed in the box on the facing page to register and download the software in this issue.

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NO CODE?

If you don't have the card insert with the unique code, you must buy the £4.99 print version of the magazine. If you have bought this, please contact letters@computersshopper.co.uk for help and a new code.



REQUIREMENTS Windows XP, Vista, 7 or 8 32/64-bit, 200MB hard disk space
WEBSITE www.projects-software.com
NOTES Get your registration code from within the application

HDR Projects 2

HIGH DYNAMIC RANGE imaging (HDR) is a smart technology for producing crisper, cleaner, more detailed digital images.

Instead of taking a single image of a scene, HDR typically involves blending several pictures, each with slightly varying exposure settings, which means you're able to capture and preserve information that would otherwise be lost. HDR Projects 2 is a powerful application that helps you create the best possible HDR images.

This starts with the process of blending your source images (known as 'exposure bracketing'). While complex in theory, HDR Projects makes your life easier by accepting up to 15 images, in all the main image and Raw formats, automatically finding and aligning the best shots.

The program is smart enough to cope with all kinds of problems and complications. Camera shakes, twists and turns aren't a problem, and automatic ghost correction can even deal with moving objects within a scene – cars travelling down a road, for example – so your picture remains crisp and clear.

Despite all the automation, HDR Projects 2 leaves you with plenty of room to make your own creative choices. The program offers seven interesting HDR algorithms, each with multiple options for fine-tuning, and a stack of spectacular filters to deliver the results you need.

The program even has an option to create an HDR version from a single image. This isn't as effective as using multiple exposures, but it does give you some capable colour- and lighting-correction tools, and should help to ensure you get the very best from your photos.

Chat and Communication

Digsby (Build 92) Access all your instant messaging services from one application; there's support for Windows Live!, Yahoo!, AIM, Google Talk, ICQ and Jabber.

UPDATED Evernote 5.9 Store your notes, ideas and plans in the cloud, and synchronise them between computers.

UPDATED Mozilla Thunderbird 38.2 A powerful email client from the organisation best known for the Firefox web browser.

Postbox Express 1.0.1 An email client that provides a comprehensive array of tools to help you manage your messages more easily.

UPDATED Skype for Windows 7.10 Make internet voice and video calls for free, and buy credit to make calls to mobiles and landlines.

Trillian 5.6 Use all your instant messaging accounts with one application; this program has support for Windows Live!, AIM, Yahoo! and Google Talk.



Customisation

UPDATED 7 Taskbar Tweaker 5 Customise the Windows 7 taskbar so that it works exactly to your liking.

Metro UI Tweaker for Windows 8

Tweak the Windows 8 user interface.

Mosaic Desktop Beta 1 Refresh

Add Windows 8's mosaic-tiled desktop to your computer without having to upgrade.

Rainmeter 3.2.1 Customise the desktop quickly and easily with your choice of information, tools and shortcuts.

Windows 8 Transformation Pack 9.1

Emulate the look of Windows 8 on an earlier version of the operating system.

Windows 10 Transformation Pack 5

Bring some of Windows 10's new features to your current operating system.



General

Free Studio 6.5 This software provides an easy way to convert your video and audio files into different formats.

Paragon Partition Manager 14 Free

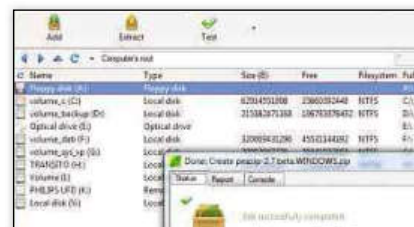
Create, format, split, merge and reorganise all your hard disk's partitions.

PeaZip 5.7 A tremendously powerful archive-management tool.

Screenshot Captor 4.12 Create and manage screenshots the easy way.

UPDATED SUMo 4.1 Quickly scan your PC's installed applications and find any updates that are available for them.

ZipGenius 6.3 A flexible file-compression tool with support for a huge number of compressed file formats.



Internet and Network

CarotDAV 1.12

Manage all your online storage services with one simple application.

Cyberduck 4.7

A powerful but easy-to-use FTP client for uploading and downloading your files.

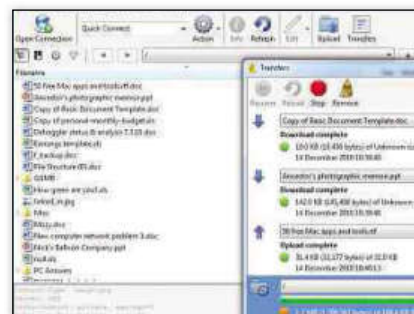
Easy WiFi 4.0

Find free Wi-Fi hotspots while you're out and about.

UPDATED NetBalancer 8.9 Make the most of your internet connection by assigning download and upload priorities to web applications.

TeamViewer 10.0 Remote-control your computer from anywhere in the world.

Vuze 5.6 A BitTorrent client to help you locate, share and download torrent files.



Tweaking and Performance

UPDATED CCleaner 5.09 Remove unwanted information, temporary files, browsing history, huge log files and even the settings that uninstalled software leaves behind.

Defraggler 2.19 Ensure your system is defragmented properly and improve its performance.

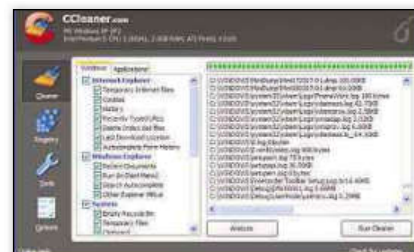
Finestra Virtual Desktops 2.5 Set up four or more virtual desktops on your PC.

UPDATED IObit Advanced SystemCare 8.4

A complete computer security, maintenance and optimisation suite.

Revo Uninstaller Free 1.95 Remove installed applications completely, including all their folders, system files and Registry entries.

Simple Performance Boost 1.0.5 Tweak the Windows Registry to give your PC a performance boost.



Crafting PCs the Scan way: Specification. Service. Satisfaction.

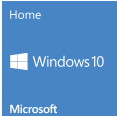


Scan V1 Value System Home / Office PC

- Intel® Pentium® G3240 processor
- 4GB Corsair DDR3 1333MHz memory
- 500GB SATA 6Gb/sec hard drive
- Windows 10

£299 Inc VAT

The V1 is a very capable entry-level system perfect from basic home/office tasks. It's based around the dual-core Intel® Pentium® G3240 processor, 4GB of RAM plus a 500GB hard disk.

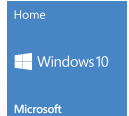


Scan V15 Value System Home / Office PC

- Intel® Core™ i5 4460 processor
- 8GB Corsair DDR3 1600MHz memory
- 1TB SATA 6Gb/sec hard drive
- Windows 10

£479 Inc VAT

The V15 ups the ante by including a quad-core Intel® Core™ i5 4460 processor, so it makes light work of office and multimedia applications.

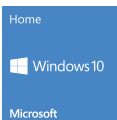


Scan G20 Value System Gaming PC

- Intel® Pentium® G3240 processor
- 8GB Corsair DDR3 1600MHz memory
- 2GB NVIDIA GeForce GTX 750 Ti SSC
- 1TB SATA 6Gb/sec hard drive
- Windows 10

£479 Inc VAT

Thanks to its dual-core Intel® Pentium® G3240 processor and NVIDIA GTX 750 Ti SSC graphics card the G20i is our most affordable gaming PC. It even includes surround sound!

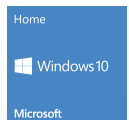


Scan G30i Value System Gaming PC

- Intel® Core™ i5 4460 processor
- 8GB Corsair DDR3 1600MHz memory
- 2GB NVIDIA GeForce GTX 960 SSC ACX
- 1TB SATA 6Gb/sec hard drive
- Windows 10

£675 Inc VAT

The combination of quad-core Intel® Core™ i5 4460 processor and NVIDIA GeForce GTX 960 SSC ACX graphics card ensures that the G30i can play any game you throw at it.



Windows 10. Do great things.



Scan Value PCs

A range of computers perfectly suited for the home/office. These affordable PCs are very flexible workhorses, capable of every task, from email/web surfing to high-end applications such as photo editing, video encoding and gaming. All of our Value Systems are pre-built and soak-tested so are ready to ship for next-day delivery.



Finance Available on
PCs above £300



Built by award
winning 3XS team



Fully soak tested



Fully 3XS
compatible



Ready to ship



2 Year Warranty
Part + Labour



The most awarded PCs and Laptops Period.

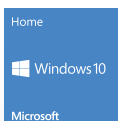


Scan 3XS Gamer 20i Gaming PC

- Intel® Core™ i7 4790 processor
- 8GB Corsair DDR3 2133MHz memory
- 4GB NVIDIA GeForce GTX 970 SC ACX
- 1TB Seagate HDD
- Windows 10
- 3 Year Premium Warranty

£999 Inc VAT

The 3XS Gamer 20i is a super-fast gaming PC thanks to its combination of quad-core Intel Core i7 4790 CPU running at 3.6GHz with added Hyper-Threading plus a 4GB NVIDIA GeForce GTX 970 graphics card. These components are installed in an Asus Z97-K motherboard along with a 1TB hard disk.

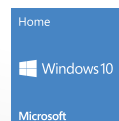


Scan 3XS Vengeance Gaming PC

- Intel® Core™ i7 6700K processor overclocked up to 4.7GHz
- 8GB Corsair DDR3 2133MHz memory
- 4GB NVIDIA GeForce GTX 980 SC
- 250GB Samsung 850 SSD & 2TB HDD
- Windows 10
- 3 Year Premium Warranty

£1525 Inc VAT

This high-end gaming system includes a Intel Core i7 6700K CPU which has Hyper-Threading and is overclocked up to 4.7GHz plus a 4GB NVIDIA GeForce GTX 980 graphics card, 8GB of 3000MHz Corsair Vengeance DDR4, an Asus Z170 Pro Gaming motherboard, 256GB PCI-E SSD and a 2TB hard disk.

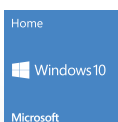


3XS Graphite LG157 Gaming Laptop

- Intel® Core™ i7 4720HQ processor
- 8GB Corsair DDR3 1600MHz memory
- 2GB NVIDIA GeForce GTX 960M
- 15.6in 1,920 x 1,080 screen
- 1TB SATA 6Gb/sec hard drive
- Windows 10

£889 Inc VAT

The LG157 is a 15.6" mid-range gaming laptop that includes a NVIDIA GeForce GTX 960M graphics card plus an Intel Core i7 4720HQ CPU, up to 16GB of RAM and multiple hard disks and SSDs. The LG157 is ready for next-day delivery and is protected by a 2 Year Premium Warranty.

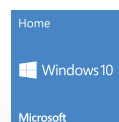


3XS Graphite LG1720 Gaming Laptop

- Intel® Core™ i7 4720HQ processor
- 8GB Corsair DDR3 1600MHz memory
- 3GB NVIDIA GeForce GTX 970M
- 17.3in 1,920 x 1,080 screen
- 1TB SATA 6Gb/sec hard drive
- Windows 10

£1075 Inc VAT

The LG1720 is a 17.3" high-end gaming laptop that includes a choice of powerful NVIDIA GeForce GTX 970M or 980M graphics card, ensuring silky smooth frame rates in all games. The LG1720 is ready for next-day delivery and has a 2 Year Warranty.



Scan Computers recommends Windows.

3XS Custom Series

Our 3XS Custom Series is a range of computers designed to offer the best performance for a variety of applications, with a particular focus on games. We build Custom Series PCs to order, so we can configure and tailor make an individual PC just the way you want it. We can also overclock the processor, so you get a faster PC without a substantial increase in price. All 3XS Custom Series PCs are covered by a three year warranty as standard with the first year on-site.



Scan 3XS Overclocked



Built by award winning 3XS team



3 Year Warranty

3XS SYSTEMS



PERFECT 10

Windows 10 laptops

There's no need to wait to get Windows 10 on the move – these 10 machines are all ready for the new operating system, and prices start at just £160

CONTENT REVIEWS

Page 80

ACER Aspire V3-574G

Page 81

DELL Inspiron 15 5000

Page 82

ASUS EeeBook X205TA

Page 83

TOSHIBA Satellite C40-C

Page 84

ACER Aspire R11 (R3-131T)

Page 85

HP Envy x360

Page 86

TOSHIBA Satellite Radius 15

Page 87

ACER Aspire Switch 10 E

Page 88

HP Pavilion x2

Page 89

TOSHIBA Satellite Click Mini

WINDOWS 10 HAS been out for a couple of months now and has been installed on millions of computers. Such are the lead times on laptops, though, that models with Windows 10 pre-installed have been very slow to arrive; of the models on test, only the Dell Inspiron 15 5000 comes with Windows 10 pre-installed.

There's no need to wait for the others, though: there are plenty of laptops out there that manufacturers have certified as being ready for Windows 10, so you can buy your new computer and perform the free upgrade without worrying about incompatibilities. It's important to have this reassurance; we've



received lots of letters about Windows 10 upgrade problems, and you want to ensure your laptop's fancy features, such as what happens when you fold back the keyboard on a convertible model, work properly.

This month we've tested 10 Windows 10-ready laptops. Most came with Windows 8.1, and we upgraded them to Windows 10 to check everything worked. We've reviewed laptops from four main categories: general-purpose laptops, netbooks, convertibles with keyboards that fold back to form a kind of tablet, and 2-in-1 hybrids, where the screen can be detached from the keyboard. Here we'll explain the differences.

GENERAL-PURPOSE LAPTOPS

General-purpose laptops strike a good balance between price and performance. You can expect dual-core and quad-core Intel Core i5 and i7 processors that will be able to handle image processing and light video editing with relative ease. In addition, many laptops costing more than £500 should come with dedicated graphics chipsets, so will be able to play the latest games.

Dedicated graphics chipsets can also help in certain video-editing applications.

Cheaper laptops don't come with dedicated graphics, but the latest Intel Core chips have integrated Intel HD 5500 graphics, which can handle some 3D games at lower resolutions, as well as more casual titles such as online card game Hearthstone.

General-purpose laptops should come with at least 1TB of storage for documents, media and games, and some have hybrid drives with a solid-state cache to make Windows more responsive. 8GB of RAM is the going rate for most laptops over £500, while cheaper models will more likely come with 4GB.

One confusing part of the laptop buying process is screen resolution; a larger size does not necessarily mean a higher resolution. We're sticklers for Full HD (1,920x1,080) screens on larger laptops, but many expensive machines still have 1,366x768 displays. Some models are available with more than one panel resolution, and some retailers don't make it clear which particular model they're selling. For this reason, if you're even remotely unsure about the screen resolution of the laptop you're buying, contact the retailer first and get them to confirm the specification in writing before you buy.

NETBOOKS

Yes, netbooks are back, and they're nowhere near as bad as you'll remember. Today's netbooks come with relatively capable quad-core Intel Atom and dual-core Celeron processors. They're not quick by any means, but as long as you're not expecting to do everything you can on a desktop PC or general-purpose laptop, a netbook can be a useful lightweight secondary device with good battery life to use on the move.

There are limitations, though. Contemporary netbooks don't come with optical drives, typically only have 32GB of storage and no more than 2GB of RAM. Our gut instinct was that this wouldn't be enough to run Windows 10, but we were pleasantly surprised with our review models. As long as you temper your expectations and don't expect to use a netbook as your primary device, they're a seriously good-value alternative to a normal ultra-portable laptop.

What you lose in performance you gain in battery life, however. These tiny devices can

go all day on a single charge, which gives them by far the best battery life of any laptop you can buy for under £800.

The main problem with such machines is that their 32GB of storage is mostly eaten up by Windows, which is a problem if you store a lot of files locally. However, these machines always come with SD or microSD card slots, so if you need more local storage you can slip in an inexpensive microSD card.

2-IN-1 HYBRIDS

Hybrid laptops, or 2-in-1s, take the form of tablets that snap on to keyboard docks. Unlike devices such as the Microsoft Surface, which have expensive optional keyboards, these devices come with snap-on keyboards that often have supplementary ports and useful extras such as built-in batteries.

In this group test we've focused on the cheaper end of the market, with the hybrids all costing under £250 and powered by Intel Atom processors, with 32GB of storage and 2GB of RAM. None has a screen larger than 10.1in, and all weigh around 1kg each. Their small size makes them fantastic on-the-road companions when you need to work on emails or do some light document editing; no touchscreen can compete with a physical keyboard when it comes to typing. Once you get home, you can just detach the screen and relax with BBC iPlayer.

CONVERTIBLES

Convertible laptops, where the hinge folds back to turn a laptop into a tablet and all kinds of stages in between, come in all sizes. They rarely look decent value if pure power is what you're after: the expensive hinges and touch-sensitive screens add a lot to the price, sometimes as much as £100 over the equivalent general-purpose laptop. However, these versatile machines do have their uses.

These devices are often marketed as 4-in-1s, with modes including 'tent', 'stand', 'tablet' and 'laptop'. These make them useful for a number of situations. For example, tent mode is useful if you're using the laptop to follow a recipe in the kitchen, where worktop space is limited, while stand mode makes it easy to get the screen at the right angle to watch a film. However, if you don't think you'll need these features, you'll get better value from a more conventional laptop.



↑ Convertible laptops can switch between four modes, making them suitable for more uses than a conventional laptop

GENERAL-PURPOSE LAPTOPS

ACER Aspire V3-574G

COMPUTER
SHOPPER
BEST BUY£566 inc VAT • From www.amazon.co.uk

VERDICT

The Acer Aspire V3-574G is the perfect blend of performance and price with very few compromises

WE'RE OFTEN ASKED which is the best laptop to play games for the least amount of money. Sometimes the criteria are impossible to meet; we've had people ask for a machine to play the latest 3D games for under £350, which simply isn't going to happen. However, spend a couple of hundred pounds more and you see laptops with basic dedicated graphics chips for playing games at low resolutions, and when you get up to the £600 mark, you start seeing credible portable gaming machines.

The Acer Aspire V3-574G is just such a laptop, and has a good enough specification to make it the only computer you'll need in the house. It's a 15.6in laptop and is no featherweight, but 2.4kg just scrapes in as something we'd carry around in a backpack.

The lid is the design highlight; it's coated in a black aluminium material that catches the light with its stylish, striped pattern. This material doesn't continue into the keyboard tray area, which instead gets rather more dull faux-aluminium plastic that feels fairly cheap.

Inside are some great components, including a dual-core Intel Core i5-5200U processor running at 2.2GHz and a mid-range Nvidia GeForce 940M for 3D performance. In our application benchmarks, which involve manipulating high-resolution images and encoding 4K video, it managed a score of 33, which is what we'd expect from a laptop with this processor. This overall score includes an image-editing score of 70, showing this laptop really shines in single-threaded applications.

There are two USB3 ports on the left edge of the laptop, along with a USB2 connector on the right. You also get a VGA connector and a full-size HDMI port, so you'll be able to

connect the V3-574G to most external displays. An SD card reader, 3.5mm headset jack and Gigabit Ethernet port round off the physical connections. There's also 802.11ac Wi-Fi for super-fast wireless networking. Storage is handled by a 1TB hybrid hard disk, which has 8GB of SSD cache to make Windows and frequently used applications load faster.

There was no problem updating to Windows 10, and the OS felt responsive. This is partly thanks to the fast processor and storage, but also because of the Precision Touchpad. This is a Microsoft initiative

The Acer Aspire V3-574G has a good enough specification to make it the only computer you'll need in the house

intended to get laptop manufacturers to include a touchpad that actually feels like it has a direct and instant connection to Windows, bringing the often poor selection of touchpads in Windows laptops somewhere close to the high standards set by Apple.

Gestures, taps, clicks and swipes are responsive, making this one of the best touchpads we've seen. The touchpad is good enough that you may not even want to plug in a USB mouse when working at your desk.

The keyboard is adequate, with reasonably grippy keys and just enough travel to make typing comfortable. It's also backlit, although the letter characters aren't translucent so all the lighting serves to do is show you where the keys are, not what's on them.

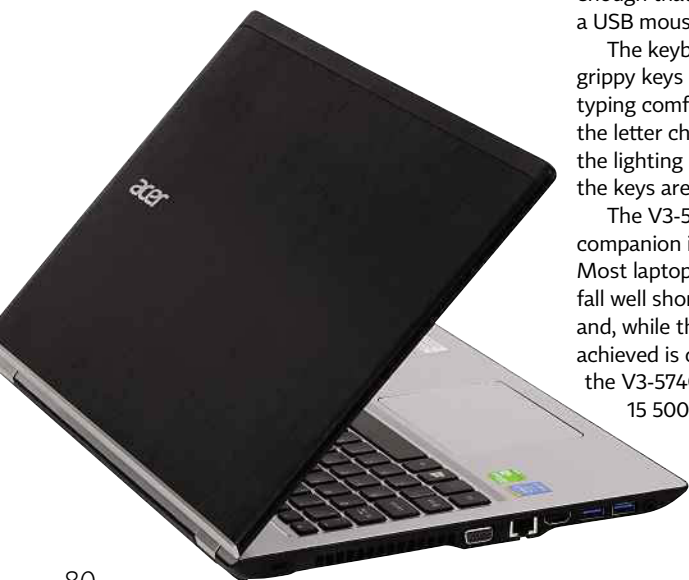
The V3-574G's credibility as a portable companion is helped by decent battery life. Most laptops with dedicated graphics tend to fall well short of four hours in our battery test and, while the 4h 22m this machine ultimately achieved is certainly nothing special, it puts the V3-574G well above the rival Dell Inspiron 15 5000, which is commendable.

3D performance is great, too. The 2GB Nvidia GeForce 940M won't be able to handle the

latest games at maximum settings, but if you do some serious graphical tweaking or drop the resolution, you'll see playable performance from many of today's 3D games. We were able to get a playable 47fps in the Dirt Showdown test at 1,920x1,080 with Medium settings and MSAA switched off, but if you'd prefer to have more graphical effects, dropping the resolution is also an option. If you're prepared to be flexible, you'll be able to have some gaming fun with this laptop.

The only area in which the V3-574G falls short is its screen quality. It can display only 58% of the sRGB colour gamut, which in itself isn't a huge problem if you're used to the fairly drab screens on cheaper laptops. It is at least bright, at 258cd/m², which goes some way to disguising its lack of colour coverage, and while 696:1 contrast is nothing to shout about, text is crisp and sharp, and vertical and horizontal viewing angles are great. The display is a compromise, but we're reasonably happy with the result.

The Acer Aspire V3-574G is a well-made and powerful mid-range laptop with enough power to tackle 3D games and most general applications, especially single-threaded ones. Considering it's just £17 more than the Dell Inspiron 15 5000 but is more powerful, it's an obvious Best Buy laptop. Acer's specification (screen, processor, RAM and storage) varies and prices change unpredictably, however, so be sure that the laptop you're buying is the same as the one we have on review here (part code NX.G1TEK.011). As we went to press Acer informed us that the model was currently out of stock at Staples and Amazon, but that new stock would be available by the first week of November.



DELL Inspiron 15 5000



£549 inc VAT • From www.dell.co.uk

VERDICT

Its build quality and battery life aren't the best we've seen, but the Inspiron 15 5000 is still decent value

DELL'S INSPIRON LAPTOPS have always been hard to beat in terms of value, thanks to their mid-range processors and modest dedicated graphics cards at reasonable prices. Last year's Dell Inspiron 5000 won a Best Buy award, thanks to its bargain price, great performance and decent battery life, so we were keen to have a look at this year's model.

Dell has gone back to the drawing board with this general-purpose laptop, keeping similarly powerful components but completely redesigning the chassis and installing a new screen. There are several Inspiron 15 5000-series models available; our review unit is the second-most powerful model, with an Intel Core i5 processor and dedicated graphics. A Core i7-powered version with dedicated graphics tops the range. There are two less powerful machines, one with a Core i5 and no dedicated graphics and a Core i3 variant, also without dedicated graphics.

In place of the 1,366x768 screen on last year's model, the new Inspiron now has a 1,920x1,080 panel, which suits the high-spec components you'll find elsewhere on the laptop. Image quality is acceptable, although you shouldn't expect accurate colours from an sRGB coverage figure of just 58%. We'd rather have a slightly drab Full HD screen than a cramped 1,366x768 panel, though.

It's not a particularly bright display, with our calibrator measuring a 210cd/m² white level at the brightest setting. This is offset by the screen's matt coating, which means bright overhead lighting and sunlight don't affect the panel as badly as they would a glossy display.

The laptop doesn't feel quite as solid as last year's. The new model is a couple of



millimetres thicker at 22mm with the lid closed, which bucks the trend of laptops getting thinner. This makes room for a DVD drive. The whole device weighs around 60g less, though, at a little over 2.3kg. It's not light, but it's also not unbearably heavy if you carry your laptop to and from work or school.

The laptop's lid will divide opinion, with a textured silver plastic that gives the effect of a robust build, but it doesn't look as good as last year's smooth, faux-metal coating. The silver plastic used for the rest of the chassis doesn't feel high quality, either, and there's a

We were able to coax it to 26fps in our Dirt Showdown 720p benchmark at High settings. You'll be able to play 3D games on this laptop at lower detail levels, and titles such as Minecraft are within easy reach. More demanding games will require significant tinkering with graphics settings, with both a resolution and overall detail reduction, but the GeForce 920M is a huge improvement over the graphics built into most laptops.

Windows 10 feels silky smooth thanks to the dual-core Intel Core i5-5200U processor and the responsive touchpad

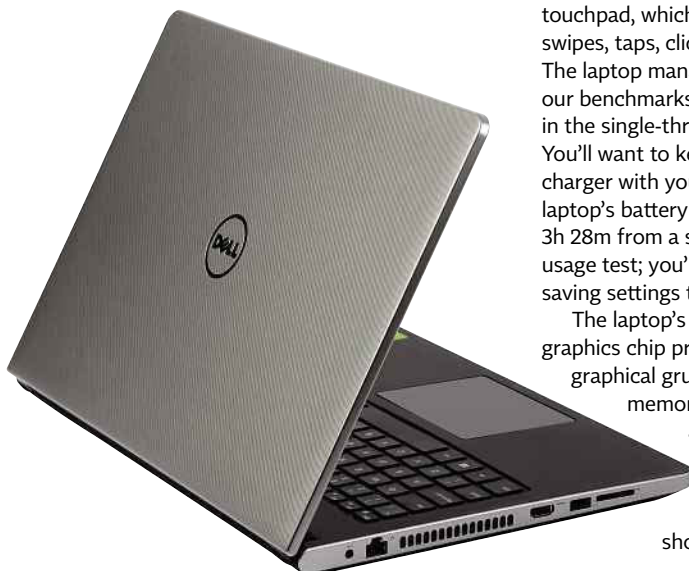
small gap between the palm rest and the keyboard tray, making a happy home for crumbs and hair. All in all, last year's model felt a lot better built.

Windows 10 feels silky smooth thanks to a combination of the dual-core Intel Core i5-5200U processor and the responsive touchpad, which works seamlessly with swipes, taps, clicks and two-fingered scrolling. The laptop managed an overall score of 35 in our benchmarks, including an impressive 58 in the single-threaded image-editing test. You'll want to keep the fairly chunky 300g charger with you at all times, though, as the laptop's battery life is mediocre. We saw just 3h 28m from a single charge in our moderate usage test; you'll need to ramp up the power saving settings to get the most out of it.

The laptop's Nvidia GeForce 920M graphics chip provides a fair amount of graphical grunt, with 4GB of dedicated memory. It's by no means a fast card and is the lowest-spec card in Nvidia's current range, but its ability to handle multimedia and games shouldn't be underestimated.

There's a single USB3 port on the left of the laptop, with a further two USB2 ports on the right side, leaving plenty of room for your peripherals. There's also an SD card reader that accepts SD, SDHC and SDXC cards, and a 3.5mm headset jack on the right side of the chassis. You won't always feel an immediate need to don your headphones, though, as the built-in speakers are loud without becoming distorted, faithfully handling dialogue and music in a well-balanced manner. There's no bass to speak of, but for a mid-range laptop, we were impressed with the speakers.

In a few ways, this year's Dell Inspiron 15 5000-series is a step down from last year's model. Build quality and battery life have both dipped, which is not something we'd expect from Dell. However, the compromises the company has made has allowed it to reinstate the DVD drive, which some users will be happy about, install a Full HD screen and bolster both the processing and graphics performance of this mid-range laptop. While it's lost some of its desirability, the Inspiron 15 5000 is still good value, but the Acer Aspire V3-574G is only £17 more and has significantly better 3D performance.



NETBOOKS

ASUS EeeBook X205TA

COMPUTER
SHOPPER
RECOMMENDED£160 inc VAT • From www.pcworld.co.uk

VERDICT

The X205TA is cheap and well built, and is a bargain even without its free Office365 offer

WE FIRST REVIEWED the Asus EeeBook X205TA last year, and it immediately became our favourite netbook-style device thanks to its great build quality, battery life and free year's subscription to Office365. The Office365 deal is only available from certain retailers, so pick carefully when you're shopping online for this device. At the time of writing, PC World is offering this laptop with free Office365 for £160, which is a great deal.

Considering it costs just £160, the EeeBook X205TA's build quality is hugely impressive. The 11.6in laptop weighs 980g, making it one of the lightest laptops we've ever tested, but this lightness hasn't resulted in compromised construction. The plastic chassis doesn't feel nearly as cheap and nasty as some of the other budget laptops we've tested. We actually found its smooth corners and squared-off edges rather attractive.

You'll find just two USB2 ports on the right edge of the laptop, and there are no USB3 ports at all, which is disappointing. You do at least get Bluetooth in addition to 802.11n Wi-Fi, so you can connect wireless peripherals easily. On the left is a microSD card slot, a headset jack and a Micro HDMI port for hooking the laptop up to an external monitor. The built-in speakers are loud and bright, if a bit tinny, so you'll want a pair of headphones for watching videos and listening to music.

The laptop's screen isn't particularly good, although the 1,366x768-pixel panel is no worse than the screens you'll find on other cheap laptops. In our calibration test it was able to display only 54.7% of the sRGB colour



gamut, while the 437:1 contrast ratio is sub-par. Horizontal viewing angles are relatively narrow but, crucially, vertical viewing angles are wide enough to not be problem when using the laptop in a confined space such as on a train.

The keyboard, meanwhile, is surprisingly capable. The keys don't have a huge amount of travel but they're light, responsive and not in the least bit spongy, making them perfectly acceptable to work on for hours on end. The touchpad is responsive, too, meaning

Bay Trail-T is also supposed to be power-efficient, and this rang true in our battery benchmark. The X205TA lasted a huge 8h 47m on a single charge, meaning a full day's work is well within its reach.

There is one big problem for users who like to have all their files stored in one place: just 9.5GB of the 32GB eMMC flash storage was available after we'd installed Microsoft

Considering it costs just £160, the EeeBook X205TA's build quality is hugely impressive

navigating around Windows and using multifingered gestures is easy.

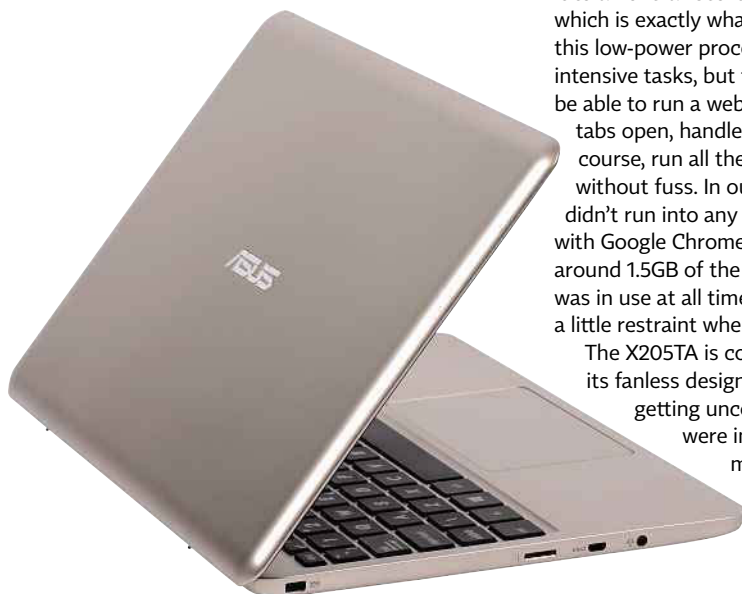
As it's so small and cheap, we weren't expecting much from the EeeBook X205TA's performance. The laptop's quad-core, 1.33GHz Atom Z3735F 'Bay Trail-T' processor powered it to an overall score of 9 in our benchmarks, which is exactly what we would expect from this low-power processor. It's no good for intensive tasks, but the laptop still needs to be able to run a web browser with plenty of tabs open, handle a few videos and, of course, run all the Office applications without fuss. In our time with the laptop we didn't run into any major problems, although with Google Chrome, Word and Excel all open around 1.5GB of the maximum 2GB of RAM was in use at all times. You'll have to exercise a little restraint when multitasking.

The X205TA is completely silent thanks to its fanless design, and we never noticed it getting uncomfortably warm. We were impressed by the machine's boot times, too: it took just 15 seconds to go from a cold boot into Windows.

Office and Google Chrome. As a result, you can't treat this laptop as you would any other general-purpose machine. Instead, you'll need to fully embrace the cloud, streaming your music from services such as Spotify or Google Play and storing bigger files on OneDrive. If you need more space, you could use a large microSD card to expand your storage; 64GB cards are around £20, but they won't be anywhere near as quick as the internal storage.

The one-year subscription to Office365 and 1TB of OneDrive storage is worth £60. This is a generous offer, and one that makes the laptop significantly better value than laptops in this price range.

It's impressive that Asus has made such a capable machine for so little. If you're happy to take your work to the cloud and don't mind paying a yearly fee of £60 for Office365 after your first free year has finished, the Asus EeeBook X205TA is a terrific buy. The only minor quibble some may have is the tiny size of its screen and keyboard, so if you want something bigger, the Toshiba Satellite C40-C is more expensive, but comes in a more work-friendly 14in size.



TOSHIBA Satellite C40-C



£200 inc VAT • From www.toshiba.co.uk

VERDICT

It won't break any performance records, but this 14in laptop will be great for office work on the move

WITH A 1.6GHz, dual-core Intel Celeron N3050 processor on board, the Toshiba C40-C is unlikely to break any speed records, unless those records are for the slowest time to complete our application benchmarks. This Toshiba model has other advantages for its price, however; its 14in screen size makes it much more suited to working on the move than other netbook-style laptops.

The Toshiba's chassis is impressively stylish for a laptop costing just £200. It may be made completely from plastic, but instead of the standard matt or glossy black material, you get a brushed metal-style look that elevates this machine above its rivals. It doesn't look as distinctive as the purple and blue HP and Asus alternatives, but Toshiba rarely ventures away from greyscale when it comes to laptop chassis design anyway.

The laptop's chassis has a fair amount of flex, but it feels well made where it counts. The keyboard's keys, for example, have reasonable feedback, while even the touchpad, normally the bane of any cheap laptop, is responsive and can handle two-fingered scrolling without stuttering.

If you keep your ambitions in check and treat this device more as a Chromebook running Windows than as a multimedia powerhouse, you shouldn't run into many problems. The processor isn't fast and the 2GB of RAM means the laptop will struggle running multiple tasks at the same time, as demonstrated by a score of 0 in our multitasking test, but if you keep only a few



browser tabs and a couple of programs open at one time you should have a frustration-free experience.

If you do try to stretch the C40-C beyond its means, it will punish you with stuttering and slow loading times as virtual memory is used instead of real RAM. If the C40-C is going to be your primary computer, you'll have to think very carefully about whether you can accept this compromise. If, however,

basic speech, but anything more challenging will require external hardware.

You also get an SD card slot, which will be crucial if you don't want to store everything in the cloud. With Windows and its restore partitions in place, you'll only have around

It may be made completely from plastic, but instead of the standard matt or glossy black material, you get a brushed metal-style look that elevates this machine above its rivals

you're considering it as a secondary laptop for when you want something small and light with you on the go, it has more appeal.

What you lose in performance you gain massively in terms of battery life. Low-power Celeron chips are known for their frugality, but we were still mightily impressed with the laptop's 11h 25m rundown time in our battery benchmark.

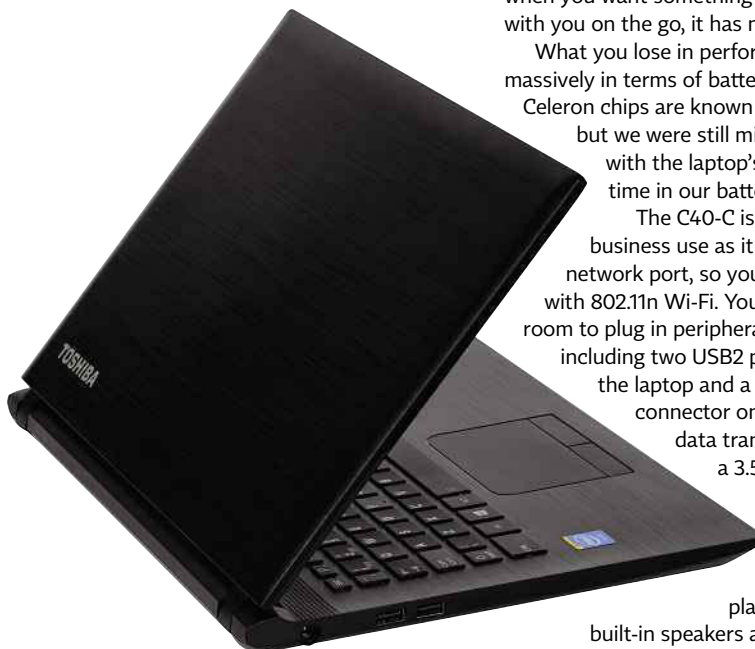
The C40-C isn't ideal for business use as it has no wired network port, so you'll have to make do with 802.11n Wi-Fi. You get plenty of room to plug in peripherals, however, including two USB2 ports on the left of the laptop and a single USB3 connector on the right for faster data transfers. There's also a 3.5mm headset jack.

You'll definitely want to plug in headphones for watching films or playing music; the built-in speakers are passable for

10GB of the 32GB eMMC flash storage left, which will be eaten up very quickly by programs and larger files. Sadly, having the SD card plugged in at all times will be an exercise in caution, as it sticks out by around half a centimetre and could catch when you pull the laptop out of your bag. You're better off using services such as Google Music and Photos to keep your media files in the cloud.

The screen is a 1,366x768-pixel panel, and while it performs every bit like a £200 laptop panel, it is at least bright – we measured a maximum brightness of 260cd/m² – and has reasonably wide viewing angles. The panel has a glossy coating, which means it's affected by overhead lighting and sunlight worse than a matt panel, but it's otherwise a decent display.

The Toshiba Satellite C40-C may be compromised in terms of performance and storage, but it does bring you a highly portable 14in laptop with excellent battery life for just £200. If you're willing to keep your files in the cloud and are realistic about the kinds of applications you can run on it, it's a good buy.



CONVERTIBLE LAPTOPS

ACER Aspire R11 (R3-131T)



£250 inc VAT • From www.currys.co.uk

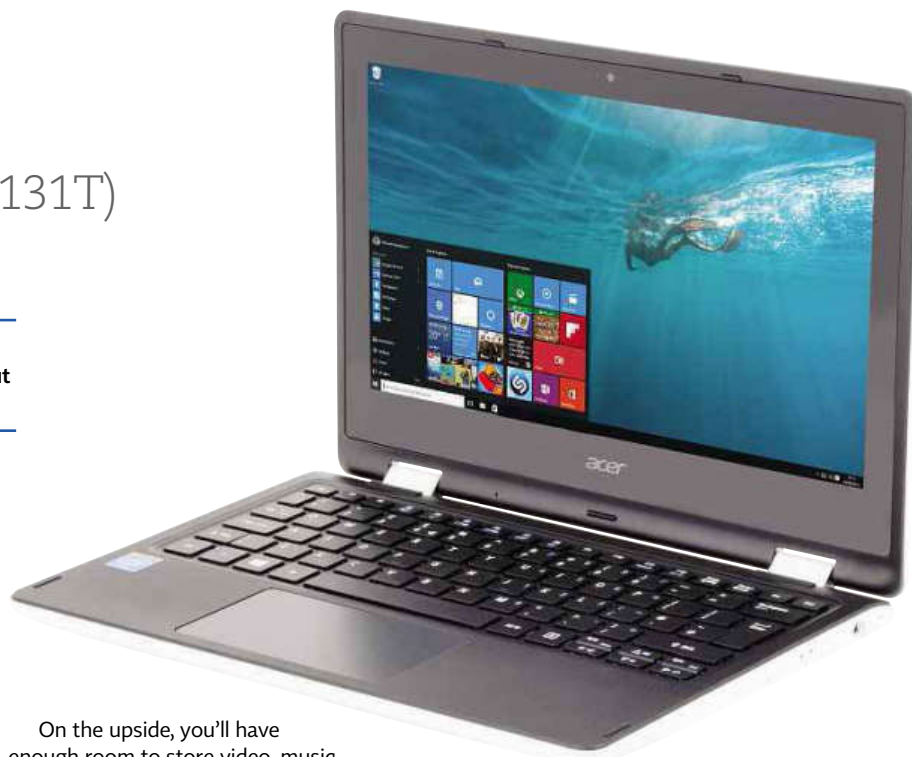
VERDICT

A sturdy convertible with fantastic battery life, but Windows 10 touchpad glitches are a big problem

THE ACER ASPIRE R11 is a small but well-formed convertible laptop that looks like it's built to last. This 11.1in convertible has a chunky hard plastic shell that looks like the sort of thing you'd buy to protect your smartphone. It feels like it's well protected against knocks and scrapes, which is something you rarely get with more expensive laptops, let alone cheap convertible models.

Specification-wise, it's more or less the same as the Toshiba Satellite C40-C netbook. The R11 has a dual-core 1.6GHz Intel Celeron N3050 processor along with 2GB of RAM. It's not a high-performance device by any stretch of the imagination, but if you choose your tasks carefully you should get by without too much trouble. The R11 scored 7 overall in our benchmark tests, including a score of 17 in the single core-focused image-editing test. This is not a laptop for intensive multimedia tasks; it will play videos just fine, and you'll be able to work on documents, emails and browse the web, but you might be left twiddling your thumbs on a few occasions while you wait for the laptop to finish crunching numbers.

One area where the R11 soundly beats the Toshiba Satellite C40-C is in storage capacity. Instead of the paltry 32GB of eMMC storage you'll find on most netbook-style devices, the R11 comes equipped with a proper 500GB mechanical hard disk. This is both a blessing and a curse; the high capacity is welcome, but it's far from the fastest drive in the world and makes Windows load slower and feel less responsive than with solid-state storage.



On the upside, you'll have enough room to store video, music and audio files on the laptop, so won't be reliant on the cloud. The laptop managed an excellent 8h 26m in our light-use battery benchmark, too, so you should be able to take advantage of all those media files.

The impressive battery hasn't added to the laptop's bulk; it cuts a svelte figure at just 1.6kg and 21mm thick. That's still too heavy to use as a conventional tablet with the keyboard flipped back, at least for any great length of time, but it's certainly light enough to carry around in a bag without weighing you down. Despite its small size, you still get a full

low-frequency sounds, so if you want to hear every explosion and every bass drum beat, you'll need headphones or external speakers.

The keyboard's keys are responsive, and the laptop's 13.3in form factor leaves enough room for larger hands. Unfortunately, though, we had some problems with the touchpad once we'd upgraded to Windows 10.

After the upgrade, we started to see significant stuttering, alongside warning beeps from the Synaptics touchpad driver software. Most touchpad gestures, even the most basic

Instead of the paltry 32GB of eMMC storage you'll find on most netbooks, the R11 comes with a 500GB hard disk

complement of the ports you'd expect from a conventional laptop. The 802.11ac Wi-Fi is supplemented by a Gigabit Ethernet port, and you also get two USB ports, one of which is USB3-compatible. There's a 3.5mm headset jack and an SD card reader, too.

The 13.3in touchscreen is relatively bright at 253cd/m², but sRGB colour coverage is below 60%, and contrast is fairly low at 433:1, meaning finer details in images are lost. The screen hinge has well-judged resistance, being easy to move when you're changing screen position but staying put when you need it to.

The laptop's speakers use 'paper diaphragm' technology, which is designed to create a minimal amount of distortion when playing high-frequency sounds at maximum volume. We were impressed with the speakers in our tests; even once we cranked the volume up to 100%, we heard no distortion whatsoever in either music and dialogue, which is a serious feat for such a small laptop.

Unsurprisingly, these small speakers can't handle

swipes and drag-select commands, failed to work, resulting in some extremely frustrating situations when attempting to edit documents and send emails. It's particularly annoying because Acer claims the R11 is ready for Windows 10, and is fully supported for a free upgrade. In our experience, we found this simply isn't the case.

We were able to partially solve these problems with an update downloaded from the Synaptics website, but although the stuttering mostly disappeared, there were still occasions when the driver software would fail and start beeping. The problem was most serious when the processor was busy with other tasks. Acer has stated in support forum posts (regarding other laptops upgraded to Windows 10 with the same problem) that investigations are ongoing, but as yet a complete solution has not been found.

For this reason, it's very difficult to recommend the Acer Aspire R11 as a Windows 10 laptop. If you buy it and don't complete the Windows 10 upgrade, you'll have a competent Windows 8.1 machine, but Windows 10 should be avoided for the moment.



HP Envy x360



£599 inc VAT • From www.very.co.uk

VERDICT

A large convertible laptop with decent performance, but it doesn't excel in any area

LARGE CONVERTIBLE LAPTOPS have always been something of a hard sell. There's the risk that you'll pay significantly more than you would for a conventional laptop but end up with something less powerful and too heavy to hold comfortably like a tablet.

HP hopes the 15.6in Envy x360 will change your mind. The laptop tips the scales at 2.3kg, so you'll need strong forearms to use it in tablet mode for any length of time. As with any convertible laptop, there are four modes to choose from: laptop, tent, tablet and stand, depending on whether you're working, watching a film, surfing the web on your sofa or following a recipe in the kitchen, for example. You don't have to worry about accidentally pressing buttons on the keyboard when in non-laptop mode, as Windows 10 disables the keyboard automatically when the hinge is bent a little beyond 180°.

The hinge is easy to operate but sturdy enough not to wobble. Otherwise the build is standard HP Envy fare; the whole device is awash with brushed aluminium. Tapering edges and sharp curves give the laptop a modern shape, but we feel the amount of metal detracts from the laptop's appeal, as there's no variety to break things up. Even the keys are silver, so the characters on each one don't contrast with the background as well as they do on a black and white model. Each key is backlit, although this should be only used in low light as the bright grey backlighting effect makes the key symbols blend into the keys themselves, making them very difficult to see in the light.

The laptop's touchpad is wonderfully responsive, with two-fingered scrolling a particular highlight. Reactions to inputs are instantaneous and feel natural, and you never feel like the touchpad is lagging behind your actions. The touchscreen is responsive, too, so makes a viable alternative to using the touchpad.

The screen itself is a little underwhelming. It's bright, with a 258cd/m² measured maximum brightness, but its colour coverage is a middling 64%, some way behind the rival convertible Toshiba Satellite Radius 15. The display has an impressive 1,004:1 contrast ratio, however, and the wide viewing angles mean you won't



have to adjust the hinge every time you move. As with all capacitive touchscreens, the Envy x360's has a glossy coating. This can make colours look more vibrant than on a matt screen, but there are two side effects: the screen is more susceptible to overhead lighting and sunlight, and fingerprints and smudges are very

little warm when the processor is under load, and the fans don't get unbearably loud, which is a testament to the cooling system HP has installed. Unfortunately, this has an

The processor's decent score in our benchmark tests is particularly impressive given that it's housed in a very thin chassis that's just 24mm thick when closed

obvious, especially when you're looking at darker images and films onscreen.

The Envy x360 has a large 1TB hard disk, but there's no room for an optical drive.

There's a Gigabit Ethernet port, two USB3 ports and a USB2 port, as well as an SD card reader and a 3.5mm headset jack.

The laptop's power button is on the side and is flush with the chassis and right at the back of the keyboard, so is difficult to press if you're switching the device on in laptop mode.

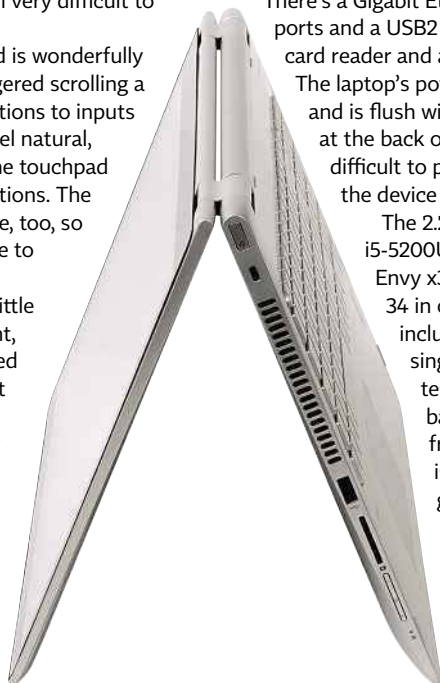
The 2.2GHz, dual-core Intel Core i5-5200U processor powered the Envy x360 to an overall score of 34 in our benchmarks, including a strong 71 in the single-core image-editing test. It's a decent score and bang on what we'd expect from this processor, which is particularly impressive given that it's housed in a very thin chassis that's just 24mm thick when closed, so the processor doesn't have much space to dissipate heat. The chassis only gets a

effect on battery life, which is not spectacular; 4h 52m is some way short of the 6h 12m achieved by the Toshiba Satellite Radius 15.

There's no dedicated graphics chip; 3D tasks are handled by the onboard Intel HD Graphics 5500. Very basic games are within the reach of this laptop, but not a lot else. Popular card-battling game Hearthstone, for example, runs fine with minimal stuttering. The laptop's speakers are loud and clear, and sound quality barely changes no matter which laptop mode you're using.

The HP Envy x360 is a decent little machine for £600, although when you consider that it costs more than significantly more powerful general-purpose laptops and weighs nearly as much to boot, it's a very hard sell indeed. As far as 15.6in convertible laptops go, it's not expensive, but it doesn't offer anything outstanding in the way of screen, performance, design or battery life.

The Toshiba Satellite Radius 15, meanwhile, has better build quality and design, a much better screen and longer battery life for £100 more. For many this will be too much of a price jump, but if you're going to buy a large convertible laptop it should offer something special, and it's the Toshiba, not the HP, that does just that.



TOSHIBA Satellite Radius 15

COMPUTER
SHOPPER
RECOMMENDED



£700 inc VAT • From www.pcworld.co.uk

VERDICT

The Satellite Radius 15 is a beautifully built and stylish convertible laptop, but it's not cheap

THE TOSHIBA SATELLITE Radius 15 certainly has an interesting design. It's a brushed aluminium beauty with all the practical features you could want from a work laptop, but it also has a 180° hinge that lets you turn it into a giant 15.6in tablet. It seems to be attempting to appeal to home users and business users at the same time, and you'll pay £700 for the privilege.

If you're going to overspend on a large convertible laptop, though, it might as well be this one. The laptop is mainly made from brushed aluminium, and there's a black plastic rim around the edge of the keyboard tray and a rugged-feeling textured material around the hinge. Even the power button looks well designed, protruding slightly from the right-hand side of the chassis with its classy soft illumination effect.

You'll find all the standard ports and connectors around the edge of the fairly svelte 20mm-thick chassis, although alongside the three USB ports (including two USB3 connectors), HDMI port and SD card reader, there's no Gigabit Ethernet port, which business users may miss. You'll have to buy a USB adaptor if you want to connect the laptop to a wired network.

The laptop's keyboard is impressive. The keys are made from a grippy, black material, with high-contrast lettering and a bright backlight. It's great for working in low-light conditions, but each key is also perfectly visible in daylight. It's easy to type quickly, as the keys have excellent feedback and a very

quiet action. The touchpad, meanwhile, is responsive, with a high-quality click from its buttons and reliable gesture controls, including pinch-to-zoom and two-fingered scrolling.

There are some decent if not especially exciting components inside the Satellite Radius 15. It matches the HP Envy x360 spec-for-spec with a 2.2GHz dual-core Intel Core i5-5200U, 8GB of RAM and a 1TB hard disk. It doesn't quite match it in terms of performance, with a slightly lower overall

runs relatively smoothly and works brilliantly on the large touchscreen.

The Satellite Radius 15's Full HD screen is fantastic. It's nice and bright, with a measured maximum brightness level of 280cd/m², and it also has a high colour-accuracy score; we measured the panel as able to cover 85% of the sRGB gamut. Colours are bright, vivid and punchy, while contrast levels of 971:1 and

Although it might not match its HP rival for performance, the Satellite Radius 15 trounces it in the battery stakes

score of 30 in our benchmarks. This is intriguing, and points towards the chip not boosting as much during intensive bouts of multitasking in order to manage heat buildup. Everyday performance in Windows 10 is fine, though, with generally snappy application performance and browsing media-heavy websites for the most part free of stuttering.

Although it might not match its HP rival for performance, the Satellite Radius 15 absolutely trounces it in the battery stakes, managing an impressive 6h 12m in our moderate usage test, well ahead of the HP's 4h 52m.

The laptop doesn't have a dedicated graphics chip, instead relying on the processor's integrated Intel HD Graphics 5500 chipset. You won't be able to play the latest 3D games on the Satellite Radius 15, although some older or simpler titles may be within the laptop's capabilities. Blizzard's Hearthstone card game, for example,

wide viewing angles mean the screen is great for viewing films and photos.

One disappointment is the quality of the Satellite Radius 15's speakers, which don't sound brilliant at any volume and are easily eclipsed by those of smaller laptops such as the Acer Aspire R11. This is perhaps a little surprising, especially when you consider the overt Harman Kardon branding next to the fake speaker grille just below the screen. The one upshot is that the sound is at least consistent, with its output sounding the same no matter how you've folded or stood up the laptop.

We're impressed by the Toshiba Satellite Radius 15. Although it's a fair bit more expensive than its convertible rivals, it justifies the price with its impressive screen, great battery life and stylish chassis. You do pay more for the laptop's convertible nature and touchscreen, and if you just need a laptop you're much better off buying a general-purpose model, which at this price will have significantly more power. If you'd like to take advantage of Windows 10's touchscreen capabilities and like to watch films on your laptop or use it in the kitchen, though, it's a good choice.



2-IN-1 HYBRIDS

ACER Aspire Switch 10 E



£249 inc VAT • From www.staples.co.uk

VERDICT

An attractive, brightly coloured hybrid that's just a little too expensive

THE ACER ASPIRE Switch 10 E is a hybrid laptop and tablet, and is the successor to the Aspire Switch 10. We weren't completely convinced by last year's model, partly because of its flimsy docking mechanism. For the Aspire Switch 10 E, Acer has improved the hinge, but not well enough in our opinion. The tablet and keyboard come apart too easily, and this is exacerbated by the stiff hinge action required to open the lid. You want to pull hard to open the tablet, but if you do, the tablet comes off in your hands.

The Switch 10 E is a versatile hybrid, and can be used in different modes including laptop, tablet and tent, so it's easy to find a comfortable angle. The hybrid comes in a choice of bold colours, including pink, orange, blue, purple and black.

Unsurprisingly considering the low price, the tablet's plastic construction feels slightly cheap and hard, but everything seems put together properly and the tablet feels relatively robust. It has a cross-hatched texture so the whole device is easy to grip. The tablet and keyboard together weigh 1.2kg, with the tablet alone tipping the scales at 624g, which is a significant 44g heavier than the rival HP Pavilion x2.

The display has a small 1,280x800 resolution, which is lower than we would like. Modern websites can feel cramped on the screen, but because the device reports itself as a PC rather than a tablet or smartphone, you'll generally get a full-size desktop site instead of a more tablet-friendly mobile one. Multitasking is out of the question, too.

The display is at least nice and bright, and viewing angles are wide. The rest of the display's performance is merely average,

however. The tablet can display a below-average 64.5% of the sRGB colour gamut, so colour accuracy isn't its strong suit. Black levels of 0.36cd/m² aren't as deep as we would have liked, but contrast was at least an average 910:1. The screen does benefit from wide viewing angles, and the hinge tilts back further than it does on most hybrids, meaning you can comfortably work with this tiny device on your lap.

Audio is supplied by two front-facing speakers on the tablet section. They're

in our benchmarks, you'll need to stick to basic applications with this laptop; don't buy this device if you're going to be processing images and videos regularly. Most people will be happiest using the Switch 10 E as a secondary machine to supplement a more powerful laptop or desktop PC.

There's a choice of 32GB or 64GB models, and you can insert a microSD card up to 128GB into the tablet segment for more

The Switch 10 E is a versatile hybrid, and can be used in different modes including laptop, tablet and tent

reasonably loud and dialogue is crisp and clear, but music and sound effect-heavy movies won't be well represented, as you'd expect. Frankly, we're just happy to have speakers that face towards us instead of away or off to one side, which says a lot about today's Windows tablets.

The laptop has a quad-core 1.33GHz Intel Atom Z3735F processor inside and 2GB of RAM and, as shown by an overall score of 9

storage. This could well be advisable if you opt for the cheaper 32GB model as you'll only be left with around 10GB storage after Windows is installed. The keyboard dock has a USB port and the Micro USB charging port on the tablet will also work with a USB OTG adaptor to let you plug in USB devices such as flash drives.

The keyboard is comfortable to type on and the keys are about as well spaced as you can expect for a 10in laptop. The keys have a pleasing amount of travel so we were able to build up to a decent typing speed after a bit of practice. After performing the Windows 10 upgrade, we paid particular attention to the touchpad; other Acer models, such as the Aspire R11, are a bit of a disaster after a Windows 10 upgrade. Fortunately, we had no problems, and gestures, swipes and clicks were all performed quickly and without fuss.

The Acer Aspire Switch 10 E is a distinctive hybrid laptop that works well with Windows 10. It has adequate performance and great battery life, but HP's Pavilion x2 is the same price and gets our vote thanks to its superior design and build quality.



HP Pavilion x2

**COMPUTER
SHOPPER**
RECOMMENDED



£250 inc VAT • From www.pcworld.co.uk

VERDICT

As both a handy tablet and an effective laptop, the Pavilion x2 is a great all-rounder

WINDOWS 10 IS much better suited to tablets than Windows 8.1 ever was, thanks to a better interface and much-improved gestures. Adding a detachable keyboard makes a Windows 10 machine an effective workhorse, too, which is why Windows 10 hybrids deserve to be popular.

The 10.1in HP Pavilion x2 is a decent and inexpensive showcase for the operating system. It's no powerhouse, scoring just 9 overall in our benchmarks, but its passively cooled, 1.33GHz quad-core Intel Atom Z3736F responds to most touch commands and gestures quickly enough. The tablet has only 2GB of memory, though, so you're rather limited in the number of tabs you can have open in your web browser, and the number of applications you can have open at one time.

The hybrid would be generally fine for light tasks, but sadly HP has preinstalled McAfee LiveSafe, which has a tendency to slow everything to a crawl. We suggest you uninstall it as soon as you can and find a less processor-heavy piece of security software.

When using the laptop to surf the web, we found sticking to Microsoft's Edge browser a more worthwhile pursuit than attempting to browse with Google Chrome. While Google Chrome will stutter as you try to scroll up and down a media-heavy page while it's still loading, Edge always feels smooth. It doesn't manage to load everything especially quickly, but we never felt as though it was holding us back. Edge's main problem is that it doesn't seem to store the tabs you have open in RAM, so it takes time to switch from one image-heavy tab to another as the device fishes it out of its page file.

The laptop's performance may be only average, but one of the most impressive things about the Pavilion x2 is the fact that it doesn't look anything like a £250 laptop. The sharply curved metallic edges, Bang & Olufsen-branded

front-facing speakers and bright screen all point towards a much more expensive device. However, once you get your hands on it, the slightly flexible plastic and low-resolution 1,280x800 screen reveal its budget origins. Even the speaker grille is a bit misleading; only a small portion of this decorative feature actually houses any speakers, and the clarity of the audio barely changes if you cover them up or face them away from you. They're loud and clear, at least, but decidedly tinny.

Around the edges of the tablet portion of the device are a single full-size USB2 port and a USB Type-C port that's used for charging.

One of the most impressive things about the Pavilion x2 is the fact that it doesn't look anything like a £250 laptop

USB Type-C is reversible, so you won't have to worry about scrabbling around to put the charger in the right way round. There's also a microSD card slot to expand the Pavilion x2's paltry 32GB of storage, much of which is consumed by Windows 10.

We were surprised that we were actually able to get some serious work done with the tablet docked into the keyboard. What's more, when using a combination of swipes and taps on the screen

and more delicate commands on the relatively responsive touchpad, we never felt hamstrung by the Pavilion x2's lack of power. As long as you stick to one task at a time and don't try video editing or manipulating huge images, the Pavilion x2 won't disappoint. The only problem we had with the keyboard is that it doesn't add any USB ports, so we couldn't connect a mouse and a USB flash drive at the same time, for example.

The display's 1,280x800-pixel resolution is small by modern standards. As on the Acer

Aspire Switch 10 E, working with multiple applications side by side is pretty much impossible, and modern, complex web pages feel cramped. You'll need to keep in mind that this is a tablet with a keyboard attached, rather than a fully fledged laptop. The screen is reasonable quality, though, with a high 1,277:1 contrast ratio and covering 62.8% of the sRGB gamut.

The Pavilion x2 managed 7h 51m in our light-usage benchmark, which is impressive but doesn't match the heights of the Acer Aspire Switch 10 E. However, if you dare to run the battery down be prepared to wait an eternity for it to recharge; it takes more than four hours. This limits the hybrid's practicality if you want to give it a quick splash of juice before moving on.

The HP Pavilion x2 works well with Windows 10, and has enough power for simple applications. Its battery life isn't up there with the Acer Aspire Switch 10 E, but we prefer its design and build quality. If you're after an inexpensive hybrid laptop, this is the one to buy.



TOSHIBA Satellite Click Mini



£189 inc VAT • From www.staples.co.uk

VERDICT

A hybrid with a lot to like, but battery life is below average

THE TOSHIBA SATELLITE Click Mini is one of the smallest hybrid laptop/tablets we've ever reviewed. With a screen just 8.9in diagonally, this is a seriously tiny device. It's coated in matt white plastic and isn't pretty, but it's not offensive or cheap-looking, either.

Including the chunky bezels, the whole device measures a little over 11 inches diagonally, which leaves room for a very small keyboard. Toshiba has done its best with this, adding secondary functions to most of the keys, including F keys on the bottom two rows of letters and brightness, volume and media controls on the number keys. This mostly works fine as these keys aren't critical to getting work done, but the one key we really dislike is the Delete key, which can only be pressed by hitting both the fn and backspace keys simultaneously. If you use the Delete key regularly, this will take some getting used to.

The experience of typing on the Click Mini is nowhere near as bad as we were expecting. It's certainly adequate for entering data, even for those with larger hands. The only area where things get cramped is on the right of the board, where the punctuation keys are half-width, with the apostrophe, semicolon and hash keys very tightly bunched up.

It's easy to build up speed on the keyboard when typing normal characters, but if you make a mistake or have to type anything beyond standard letters, things slow down a bit. Still, it's a usable work device if you don't want to lug a big laptop around with you. The touchpad, which is almost comically small, is sensitive and responsive and even works with multifingered gestures. Despite its small size, we had no problems using it.

The whole device weighs just 1kg, putting it firmly in netbook territory. The tablet portion weighs 470g, which is around 45g more than a similarly sized standard

tablet such as the Google Nexus 9. In addition to the keyboard, the docking portion of the Click Mini includes a full-size USB2 port, an SD card reader and, crucially, a second battery. This is essential, as even with both batteries working together we saw only 6h 38m in our light-use battery test, which is much less than we were expecting.

You can charge the whole device via the Micro USB port on the tablet portion. The tablet battery is charged first, and only when it reaches 100% charge does the dock's

best out of the display. Performance is about at what we'd expect from a budget laptop, with the panel able to cover 58% of the sRGB colour gamut, with a reasonable maximum 270cd/m² brightness, a strong 1,007:1 contrast ratio and wide viewing angles.

The Click Mini is powered by an Intel Atom Z3735F processor clocked to 1.33GHz. This quad-core chip is very popular in

We are at a bit of a loss as to why Toshiba thought it would be a good idea to fit speakers on the bottom of the device

battery start to take on power. To charge the entire device takes an absolute age, though; we waited more than four hours for both the tablet and the keyboard to get to maximum.

Despite its tiny size, the tablet has a high-resolution 1,920x1,200 screen. Although this makes everything look super sharp, application interfaces and icons are rather small. You'll need to tinker with Windows 10's display scaling options in order to get the

netbook-style devices and hybrids, and it managed an overall score of 9 in our benchmarks. It's not fast in a sprint, and it's even slower in a marathon, but it will handle web browsing and simple applications with ease. Even better, if you fancy playing some simpler games, we found both Minecraft Windows 10 Edition and Hearthstone ran smoothly enough for us to enjoy them both.

We are at a bit of a loss as to why Toshiba thought it would be a good idea to fit speakers on the bottom of both the right and left edges of the device. Audio performance is fine for a tiny, thin, cheap tablet, but if you're using the tablet like a normal person, your hands will cover the speakers, completely muffling the sound. It's a totally bizarre choice and means you have to cup the tablet or lean it on something in order to hear clearly. We would have preferred rear-facing speakers, and that's saying something.

The Toshiba Satellite Click Mini is close to being a great device, but it's let down by odd speaker design, below-average battery life, and an unusual keyboard. If you think these things won't bother you, though, it's a decent enough buy for under £190.



The craziest Windows hybrids

THE LAPTOPS IN this month's group test can be divided into three reasonably neat categories: normal laptops, convertibles with fold-back keyboards, and hybrid laptop/tablets with detachable keyboards. The Windows laptop market hasn't

always been so simple, though. When Windows 8 first appeared on the scene in 2012, manufacturers, to their credit, tried some designs that look faintly ridiculous to us now. Still, nothing ventured, nothing gained, right?

Asus Transformer Book Trio

Perhaps one of the most confusing laptops we've ever tested, the Transformer Book Trio had two processors, two sets of RAM, two hard disks and two operating systems: Windows 8 and Android.

What we said:

The Transformer Book Trio gave reviewer Katharine Byrne a headache as she performed two sets of benchmarks on a laptop with a real identity crisis. She awarded the £900 device a four-star rating, concluding: "[It] might seem overpriced, but you're getting two products in one device for the price of one laptop. Neither device is particularly exceptional on its own, but the combination of the two makes this one of the best-value hybrids available."

The Transformer Book Trio ran both Android and Windows



Sony Vaio Tap 20

In 2012, Sony decided the world needed a 20in tablet/all-in-one PC. This behemoth weighed a massive 5kg and came with a battery and stand, meaning you could move it around your home to where it was needed. It came with a proper dual-core processor and a 1,600x900-pixel screen, and would even work in portrait mode if you had the strength to turn it upright.

What we said:

The Tap 20 divided opinion among technology journalists, but *Shopper* reviewer Kat Orphanides loved the hybrid and awarded it a maximum 5-star rating, saying: "The Tap 20 feels like a genuine step forward in all-in-one PC design: lighter, better looking and more portable than anything else on the market. It's all rather futuristic, even compared to other all-in-ones, let alone regular desktop machines... It's brilliant to use, very tactile and we'd love to have one."

You'd need a fair amount of strength to carry this 5kg 'tablet' around



Dell XPS 12

Dell's XPS 12 was one of the first hybrids on the scene. Instead of a keyboard that would fold all the way back, this hybrid's 12in screen sat inside a frame, and the display could be rotated so it could be used as a laptop or a tablet. It was a great screen, too; a Full HD panel in such a small device was a luxury at the time. You paid for that design, though; the XPS 12 was more than £1,200.

What we said:

Katharine Byrne loved the XPS 12: "Not without its flaws, but if you can cope with its limited ports, it's a superb laptop-tablet hybrid that's much easier to use than the competition. It's also one of the most powerful convertibles we've seen, so if you want a device with the power of a laptop and the fun factor of a tablet, this is the hybrid to buy."

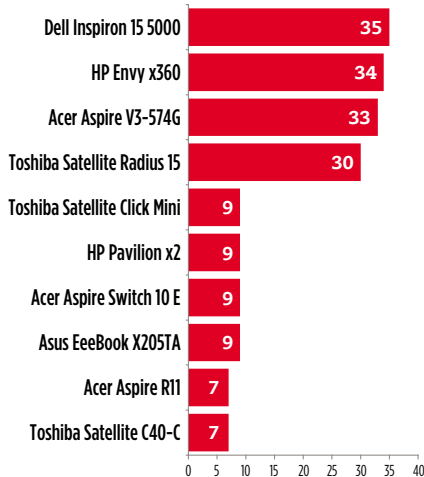
With its spinning screen, the XPS 12 took an original approach to hybrid design



BENCHMARKS

2D performance

Overall



Multitasking

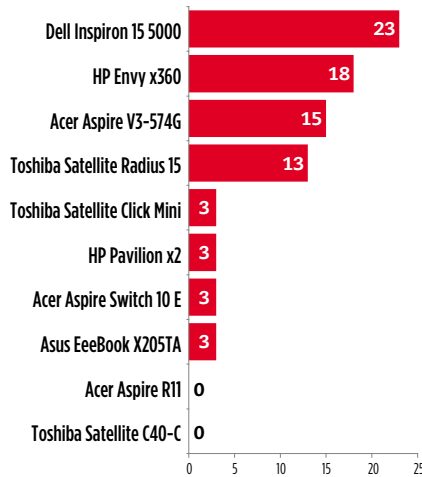
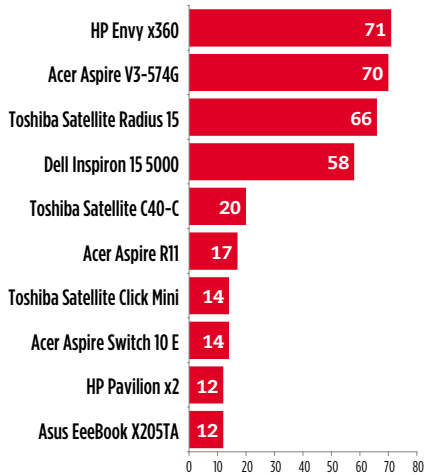
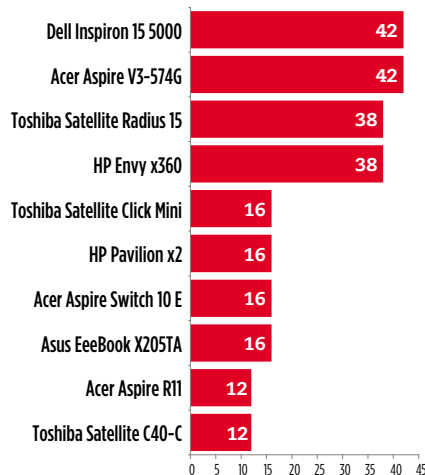


Image editing

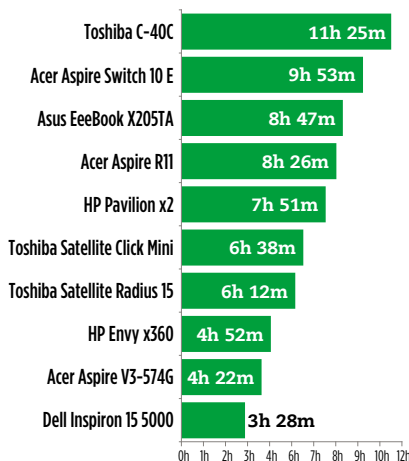


Video encoding



Battery life

Light-usage test (hours)



Our battery test involves light browser use with the screen at its medium brightness setting.

SETTINGS Native resolution, screen at half brightness

Our benchmark suite allows us to compare Windows, Mac OS X and Linux PCs.

The tests use open-source applications to gauge a laptop's performance, and comprise image-editing, video-editing and multitasking elements. These scores are combined to produce the overall score.

Our reference PC is fitted with an Intel Core i5-4670K processor and 8GB of DDR3 RAM. We have normalised all its results to 100, which makes it easy to draw comparisons. We use the same tests in all our reviews.

You can download the tests for free from bit.ly/shopperbenchmarks.

SETTINGS We run our application tests at native resolution
WEB bit.ly/shopperbenchmarks



VERDICT

There's so much variety in the laptop market that there really is something for everyone in this month's group test. Whether you're after a cheap and portable netbook with excellent battery life, a powerful general-purpose laptop or a fun tablet hybrid, one of the devices here test is sure to suit you.

Our favourite netbook-style device remains the Asus EeeBook X205TA. It's a tiny, capable device with strong battery life at a rock-bottom price, and wins a Recommended award. If you need a bit more power, the Acer Aspire V3-574G's powerful processor and capable dedicated graphics make it a viable contender to be the only computer you need in your house. It wins a Best Buy award, but you'll have to wait until November to get hold of one.

If you're keen on a Windows 10 tablet that will also make a reasonable laptop, the Recommended award-winning HP Pavilion x2 is for you. It's cheap, practical and feels well made, making it a great choice if you want one device for casual tablet tasks as well as some light office work.

Finally, the Toshiba Satellite Radius 15 is an expensive but undeniably classy convertible that will motor through any work tasks you throw at it.

ACER

Aspire V3-574G

★★★★★

COMPUTER SHOPPER
BEST BUY



ASUS

EeeBook X205TA

★★★★☆

COMPUTER SHOPPER
RECOMMENDED



TOSHIBA Satellite
Radius 15

★★★★☆

COMPUTER SHOPPER
RECOMMENDED



HP

Pavilion x2

★★★★☆

COMPUTER SHOPPER
RECOMMENDED



	GENERAL-PURPOSE LAPTOPS		NETBOOKS	
	BEST BUY		RECOMMENDED	
	ACER	DELL	ASUS	TOSHIBA
	Aspire V3-574G	Inspiron 15 5000	EeeBook X205TA	Satellite C40-C
	★★★★★	★★★★☆	★★★★☆	★★★★☆
CORE SPECS				
Processor	Dual-core 2.2GHz Intel Core i5-5200U	Dual-core 2.2GHz Intel Core i5-5200U	Quad-core 1.33GHz Intel Atom Z3735F	Dual-core 1.6GHz Intel Celeron N3050
RAM	8GB	8GB	2GB	2GB
Memory slots (free)	2 (1)	2 (0)	1 (0)	1 (0)
Max memory	16GB	16GB	2GB	2GB
Size	500x306x68mm	380x260x24mm	286x193x18mm	344x244x23mm
Weight	2.4kg	2.3kg	980g	1.7kg
Sound output	3.5mm headset port	3.5mm headset port	3.5mm headset port	3.5mm headset port
Pointing device	Touchpad	Touchpad	Touchpad	Touchpad
DISPLAY				
Screen size	15.6in	15.6in	11.6in	14in
Screen resolution	1,920x1,080	1,920x1,080	1,366x768	1,366x768
Touchscreen	No	No	No	No
Graphics adaptor	Nvidia GeForce 940M	Nvidia GeForce 920M	Intel HD Graphics	Intel HD Graphics
Graphics outputs	HDMI, VGA	HDMI	Micro HDMI	HDMI
Graphics memory	2GB	4GB	Shared	Shared
STORAGE				
Total storage	1TB SSHD	1TB hard disk	32GB eMMC	32GB eMMC
Optical drive type	DVD-RW	DVD-RW	None	None
PORTS AND EXPANSION				
USB ports	2x USB3, 1x USB2	1x USB3, 2x USB2	2x USB2	1x USB3, 2x USB2
Bluetooth	Yes	Yes	Yes	Yes
Networking	802.11ac Wi-Fi, Gigabit Ethernet	802.11ac Wi-Fi, Gigabit Ethernet	802.11n Wi-Fi	802.11n Wi-Fi
Memory card reader	SD	SD	MicroSD	SD
Other ports	None	None	None	None
SOFTWARE				
Operating system	Windows 8.1 64-bit (free upgrade to Windows 10)	Windows 10 64-bit	Windows 8.1 32-bit (free upgrade to Windows 10)	Windows 8.1 64-bit (free upgrade to Windows 10)
OS restore option	Windows restore	Windows restore	Windows restore	Windows restore
BUYING INFORMATION				
Parts and labour warranty	One year RTB	One year collect and return	One year collect and return	One year RTB
Price inc VAT	£566	£549	£160	£200
Details	www.acer.co.uk	www.dell.co.uk	www.asus.com/uk	www.toshiba.co.uk
Supplier	www.amazon.co.uk	www.dell.co.uk	www.pcworld.co.uk	www.toshiba.co.uk
Part code	NX.G1TEK.011	BN55807	X205TA-BING-FD15BS	C40-C-10K

CONVERTIBLE LAPTOPS			2-IN-1 HYBRIDS		
		RECOMMENDED			RECOMMENDED
ACER	HP	TOSHIBA	ACER	HP	TOSHIBA
Aspire R11 (R3-131T)	Envy x360	Satellite Radius 15	Aspire Switch 10 E	Pavilion x2	Satellite Click Mini
★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Dual-core 1.6GHz Intel Celeron N3050	Dual-core 2.2GHz Intel Core i5-5200U	Dual-core 2.2GHz Intel Core i5-5200U	Quad-core 1.33GHz Intel Atom Z3735F	Quad-core 1.33GHz Intel Atom Z3736F	Quad-core 1.33GHz Intel Atom Z3735F
2GB	8GB	8GB	2GB	2GB	2GB
1 (0)	1 (0)	2 (1)	N/A	N/A	N/A
2GB	8GB	16GB	N/A	N/A	N/A
298x211x21mm	382x250x24mm	380x245x20mm	262x180x23mm	264x173x20mm	235x161x10mm
1.6kg	2.3kg	2.3kg	1.2kg	1.2kg	1kg
3.5mm headset port	3.5mm headset port	3.5mm headset port	3.5mm headset port	3.5mm headset port	3.5mm headset port
Touchpad	Touchpad	Touchpad	Touchpad	Touchpad	Touchpad
11.1in	15.6in	15.6in	10.1in	10.1in	8.9in
1,366x768	1,920x1,080	1,920x1,080	1,280x800	1,280x800	1,920x1,200
Yes	Yes	Yes	Yes	Yes	Yes
Intel HD Graphics	Intel HD Graphics 5500	Intel HD Graphics 5500	Intel HD Graphics	Intel HD Graphics	Intel HD Graphics
HDMI	HDMI	HDMI	Micro HDMI	Micro HDMI	Micro HDMI
Shared	Shared	Shared	Shared	Shared	Shared
500GB hard disk	1TB hard disk	1TB hard disk	32GB eMMC	32GB eMMC	32GB eMMC
None	None	None	None	None	None
1x USB3, 1x USB2	2x USB3, 1x USB2	2x USB3, 1x USB2	1x USB2	1x USB3, 1x USB Type-C	1x USB2, 1x Micro USB
Yes	Yes	Yes	Yes	Yes	Yes
802.11ac Wi-Fi, Gigabit Ethernet	802.11ac, Gigabit Ethernet	802.11ac Wi-Fi	802.11n Wi-Fi	802.11n Wi-Fi	802.11n Wi-Fi
SD	SD	SD	MicroSD	MicroSD	SD
None	None	None	None	None	None
Windows 8.1 32-bit (free upgrade to Windows 10)	Windows 8.1 64-bit (free upgrade to Windows 10)	Windows 8.1 64-bit (free upgrade to Windows 10)	Windows 8.1 32-bit (free upgrade to Windows 10)	Windows 8.1 32-bit (free upgrade to Windows 10)	Windows 8.1 32-bit (free upgrade to Windows 10)
Windows restore	Windows restore	Windows restore	Windows restore	Windows restore	Windows restore
One year RTB	One year collect and return	One year RTB	One year RTB	One year collect and return	One year RTB
£250	£599	£700	£249	£250	£189
www.acer.co.uk	www.hp.co.uk	www.toshiba.co.uk	www.acer.co.uk	www.hp.co.uk	www.toshiba.co.uk
www.currys.co.uk	www.very.co.uk	www.pcworld.co.uk	www.staples.co.uk	www.pcworld.co.uk	www.staples.co.uk
NX.G0YEK.003	M1N37EA#ABU	P50W-C-10E	SW5-012-11E6	10-n054sa	L9W-B-102

Prices correct at time of going to press

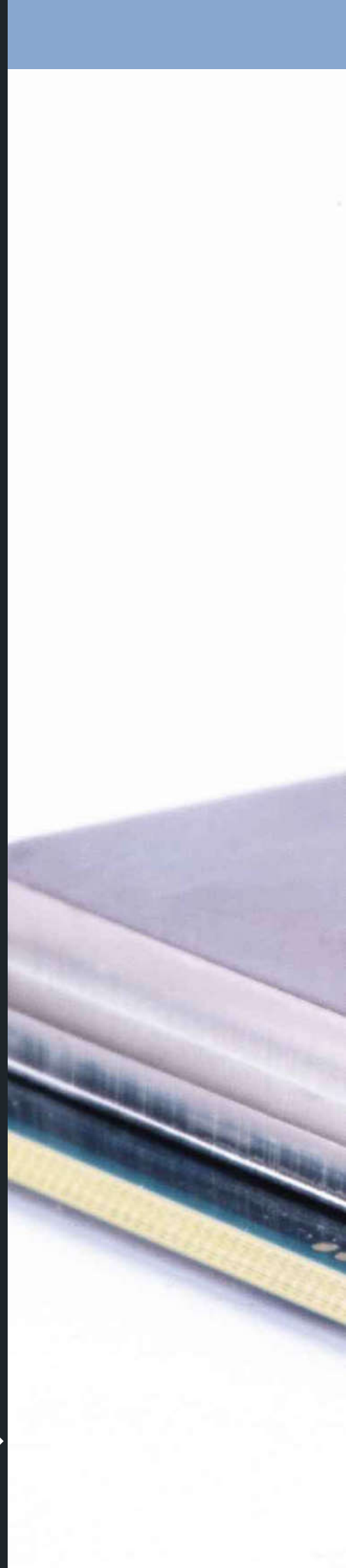
MOORE'S LAW

at
50

**MIKE BEDFORD CONFRONTS THE FULL
FORCE OF THE LAW THAT'S DOMINATED
COMPUTING FOR 50 YEARS**

Back in 1965, the country was gripped by Beatlemania, as the Fab Four released *Help!*, *Yesterday* and *Nowhere Man*. Across the pond in San Francisco, the nascent flower power movement was about to usher in the hippy era. NASA's second-generation manned spacecraft, Gemini, flew for the first time, although it would be another four years before Apollo 11 landed man on the Moon. Harold Wilson was in Number 10, average UK annual income was £751, and you could buy a house for £3,660, a Mini for around £500, and a pint of bitter for 9p. Computing was dominated by million-pound mainframes and ten thousand-pound mini-computers; the microprocessor, and its promise of desktop computing, was still six years away.

While the world of 1965 is hardly recognisable today, it was in that year that Intel co-founder Gordon Moore commented on a trend in the microelectronics industry that has held true, more or less, ever since. Here we celebrate the 50th anniversary of Moore's Law to see just what this pioneer of the electronic age foresaw, how it's panned out, what it means to us today, and look at several other trends that have dominated the world of computer chips for the last half a century.



Creating a modern
Intel processor with
technology from 1971
would result in a chip
some four metres across





THE REAL MOORE'S LAW

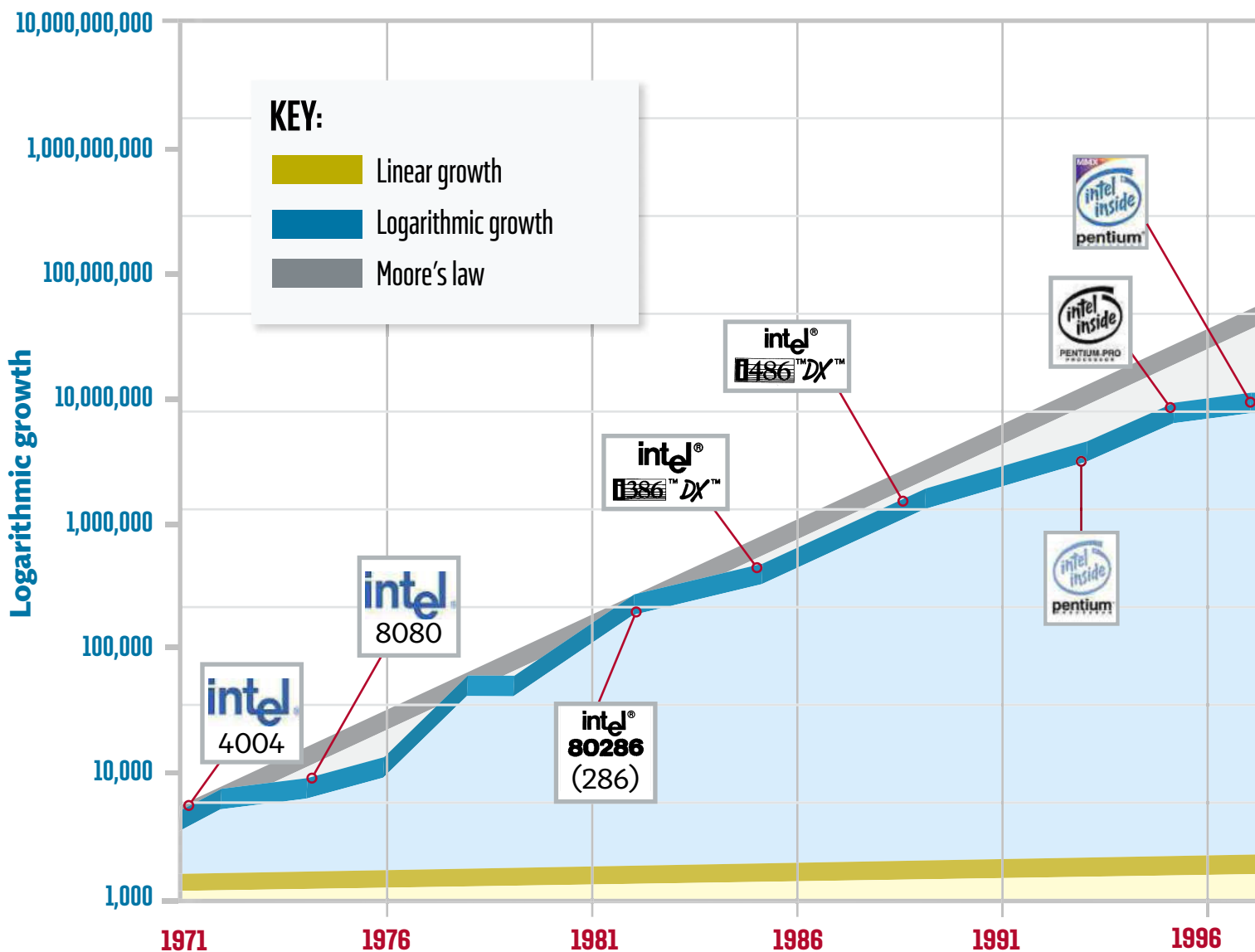
If we're going to commemorate Moore's Law, we ought to make sure we get our facts right because this is one area where half truths are rife. The commonly held view that Gordon Moore predicted a doubling of processor speeds every two years, for example, doesn't bear any resemblance to what he actually said (even though, as it so happens, this particular trend has also held true). The statement in question appeared in a 1965 article by Moore, published in the industry magazine *Electronics*; it suggested that "the complexity for minimum component costs has increased at a rate of roughly a factor of two per year". This was followed by something that has the sound of a prediction

about it, though Moore never referred to it as a law. "Certainly over the short term this rate can be expected to continue, if not to increase. Over the longer term, the rate of increase is a bit more uncertain, although there is no reason to believe it will not remain nearly constant for at least 10 years. That means by 1975, the number of components per integrated circuit for minimum cost will be 65,000."

According to Moore, that figure of "complexity for minimum component costs" was 65 transistors in 1965. There were chips with fewer transistors, and there were more complicated integrated circuits in existence, but those in which the transistors worked out cheapest had 65 transistors. These components weren't microprocessors,

GROWTH IN TRANSISTOR NUMBERS SINCE 1971

Gordon Moore spotted a remarkably simple trend that has held true throughout the

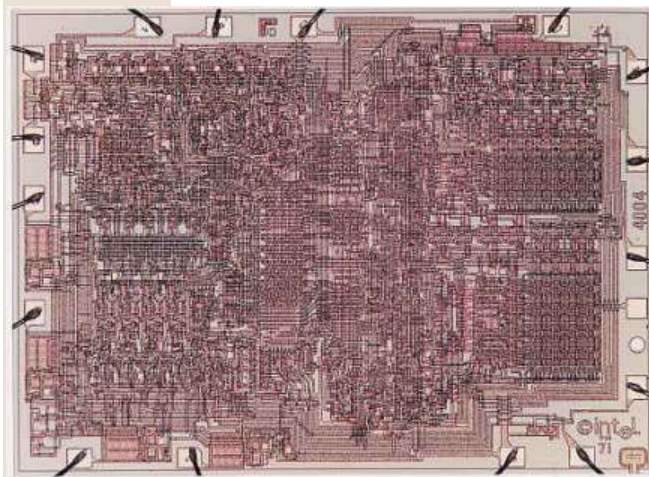


The commonly held view that Moore predicted a doubling of processor speeds every two years doesn't bear any resemblance to what he said

since no such thing existed at the time. Instead they were logic chips such as the NOR-gates, NAND-gates and inverters that were the building blocks of large-scale computers, where they were used in their thousands. A few years later the most economical chips would be solid-state memories, Intel's first product line, and in time they would become microprocessors. So, bringing that statement into today's

terms, it wouldn't be far off the mark to suggest that Moore's prediction was that the number of transistors in a mainstream microprocessor would double every year.

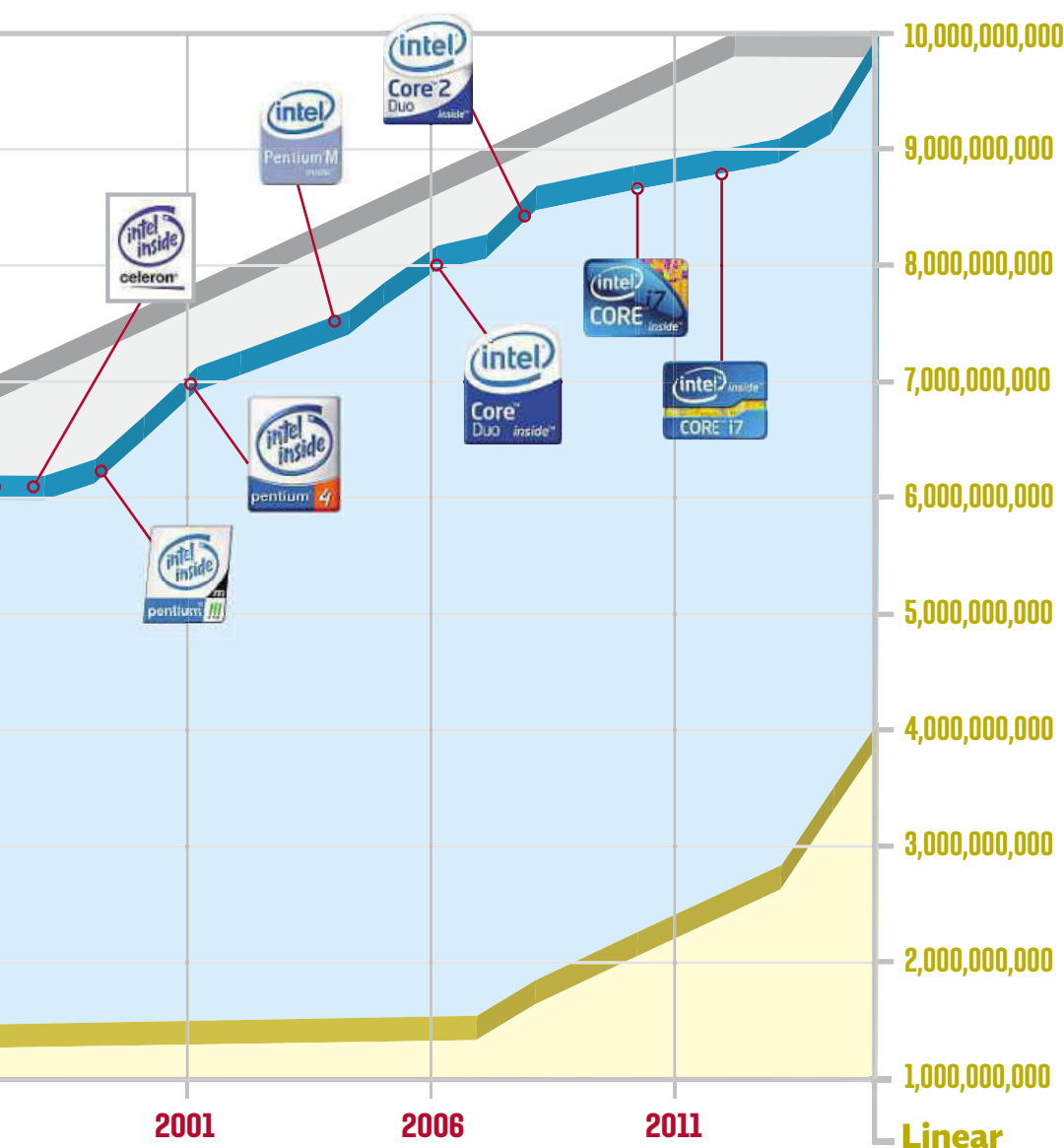
Although we're celebrating 50 years of his law, we shouldn't lose sight of the fact that Moore had confidence that the trend he'd observed would hold true for only another 10 years, admitting that beyond that it was more



Intel's 4004 was a miracle of miniaturisation, but features have become half a million times smaller since then

uncertain. Indeed, in 1975, he amended his predicted rate to a doubling every two years instead of every year. Given that this was the era of the Intel 8080 and the Motorola 6800, both 8-bit microprocessors and some of the first to be used in desktop computers, that amended prediction goes back to the very birth of personal computers. As such, it gives us the opportunity to see how reality has compared to prophecy.

whole era of the microprocessor

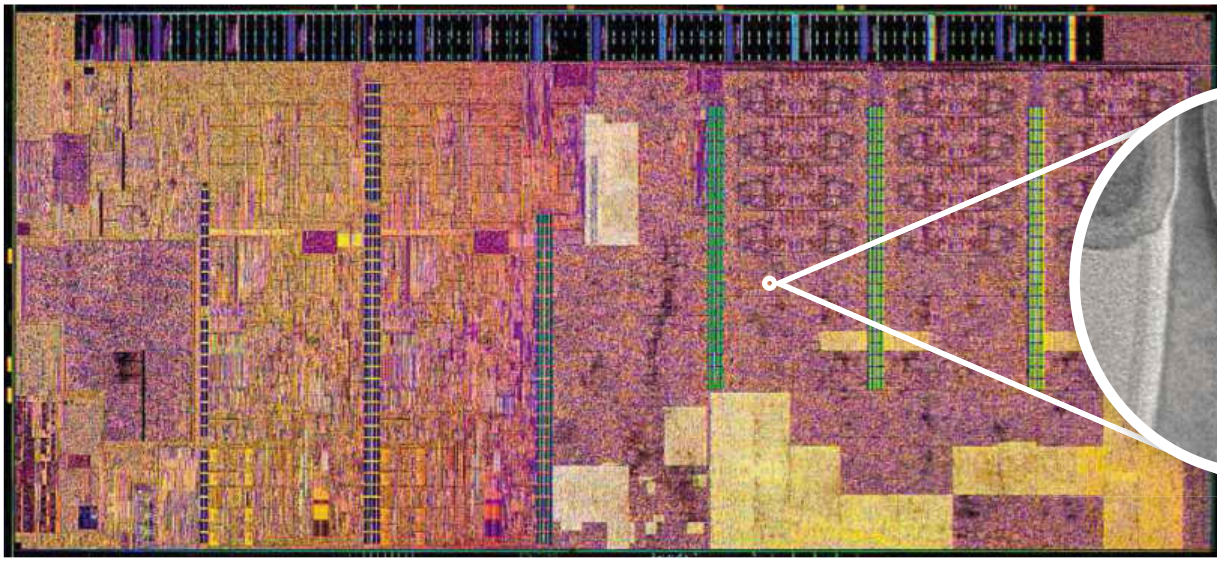


TRANSISTORS OF MERCY

The yellow area on the graph (left) shows how the number of transistors per microprocessor has increased since 1971 for some prominent products, including Intel's 4004, 8080 and the x86 family. The way the yellow area represents the data isn't too helpful because nothing seems to change until about 2001. In fact, there were huge year-on-year increases from the very start in percentage terms but, because the figures are so small in comparison to today's billions, we just can't see the trend at the start.

As you'll probably recall from school maths lessons, Moore's growth rate, defined as a doubling in a given time period, is referred to as exponential, and this sort of linear graph isn't the best way to illustrate it. Instead, it needs to be plotted logarithmically, so the growth will appear as a straight line. The blue area is the same prominent products but now plotted on a logarithmic axis. Also plotted on the logarithmic axis is a grey line, which represents the theoretical growth rate for a doubling every two years. The closeness of the blue area – upset only by an apparent brief hiccup in the mid-90s – is testimony to Moore's predictive abilities.

Recognising that the law that carries his name is often misquoted, and that many other aspects of microelectronics have also risen at similar rates, in a recent speech Gordon Moore joked that he was the inventor of the exponential. In reality, not everything has increased or decreased exponentially and some trends have been much more sedate. Exponential or not, though, let's delve into some of



This modern Intel Broadwell chip measures just 82mm square (shown at x130), yet it contains a total of 1.3 billion transistors (with a single one pictured). With a feature size of 14nm, these transistors are many thousand of times smaller than a human hair

the other astounding trends of the last few decades, trends that have either fuelled Moore's Law or have been a consequence of it.

THE AMAZING SHRINKING CHIP

If it wasn't for the events of the last half a century, we'd probably think that even the very first microprocessor, the Intel 4004, was a miracle of miniaturisation. With integrated circuits still in their infancy, to most electronic engineers a transistor was a little glass or metal cylinder, about 5mm in diameter and 15mm long, with three leads attached to it. Yet the 4004 was a tiny chip of silicon measuring 3x4mm, on to which no fewer than 2,300 transistors were etched.

This was achieved using a 10µm process, which means that the minimum feature size was 10 micrometres or one hundredth of a millimetre. The massive increase in the transistor count that was predicted by Gordon Moore has been accompanied by a steady decrease in the feature size, also exponential, but why was that necessary?

The first reason is fairly obvious. Today's top-end microprocessors, such as the eight-core Core i7 Haswell-E, have 2.6 billion transistors, or just over a million times the 4004's transistor count. Using the same feature size as the 4004, its die would measure three metres by four metres, which wouldn't exactly lend itself to use in a server, let alone a desktop computer. This is just a start, though, as other imperatives have also been responsible for ensuring that the big squeeze remained on track.

In the realm of everyday objects, it seems that small things are invariably faster than large ones. So a humming bird is able to flap its wings much more rapidly than a golden eagle, and a short organ pipe can generate a higher pitched note, corresponding to the air vibrating more rapidly, than a long

organ pipe. Much the same applies to the world of electronics. However, it's not because the electrons have a shorter distance to travel in a smaller chip, as is sometimes suggested, since as yet this hasn't become the overriding issue. Instead, it comes down to capacitance.

To cut a long story short, the capacitance of the transistors on a chip decreases as their dimensions decrease, and this in turn allows them to be switched on and off more quickly. And so, for many years, the size of a transistor's gate – referred to as the process size – decreased by 30% every two years or so, so the on-chip area halved, which led to a doubling of the processor's clock frequency.

It's not entirely clear what the process size was back in 1965 when Moore's Law was first postulated but,

The massive increase in the transistor count predicted by Moore has been accompanied by a steady decrease in the feature size

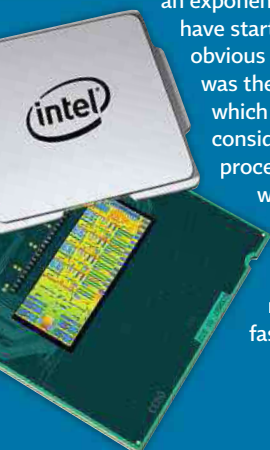
The trend that ran out of steam

Not everything in the world of microelectronics has continued to grow at an exponential rate, even if they might have started out that way. The most obvious trend that hit the buffers was the increase in clock speeds, which for many years was considered as a measure of processing speed. In reality, it was only a measure of speed if all other things remained equal. So, while a 50MHz Intel 486DX might have been twice as fast as the 25MHz equivalent,

the 60MHz Pentium that followed them was much faster than the difference in clock speed might suggest. Even so, the 'megahertz wars' occupied the minds of PC users for many years.

At the outset, just like everything else in this exciting new industry, increases came year on year and followed the familiar pattern of exponential growth. The 4004 was clocked at 108kHz (0.108MHz) when it first launched and, by the time the Pentium 4 arrived in 2000, that figure had increased to 1.5GHz (1,500MHz). As with so many trends, that corresponds to a doubling every two

years. Had that continued, we'd have passed 100GHz in 2012 and today's processors would be boasting clock speeds in excess of 200GHz. History tells a different story. The Pentium 4 saw a top speed of 3.8GHz in 2004, much less than would be expected from another two doublings, and less even than the 4GHz that Intel had originally planned. Today's highest headline figure for mainstream chips has only just reached the 4GHz figure that was eagerly anticipated of the Pentium 4 over 10 years ago.



108kHz 1.5GHz 4GHz 5G

The vexed question of speed

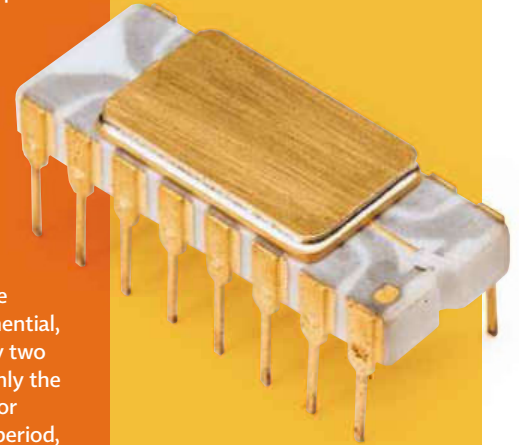
Given that so many people think Moore's Law is about increases in processor speed, we can't ignore the question of how speeds have risen over the years. The difficulty is that we're now moving into a grey area. The number of transistors on a chip is easy to quantify, as is the price per transistor and the minimum feature size. But what do we mean by speed?

At one time, there was a naive view that the clock frequency of a microprocessor was a measure of speed, but it's easy to show the fallacy of this perception. Had this been the case, bearing in mind that clock speeds have barely risen for years, today's chips would be little faster than a 2004 Pentium 4, which was clocked at 3.8GHz. In fact, a whole series of architectural advancements have also brought performance gains. Here we could mention pipelining, superscalar architectures and multiple cores which, alongside the clock speed, dictate how many instructions can be executed each second. But even a measure of instructions per second isn't an accurate measure of real-world speed because not all instructions are equal. For example, today's

64-bit instructions can do more work than the 32-bit, 16-bit, 8-bit and 4-bit instructions of earlier architectures. We also have to recognise that it's quite possible for one processor to outperform another for some applications but the converse to be true for others.

Despite all this – and not forgetting that this is a rough estimate – it's appropriate to quote some figures that purport to show how processor performance has increased since the early days of Moore's Law. A common measure of processor speed is the Dhrystone, which is reported in millions of instructions per second (Mips) for a standard mix of instructions, and the improvement has been dramatic. The 4004 managed about 0.1 Mips, while a modern eight-core processor clocks up a massive 238,310 Mips. The trend has been exponential, and works out at a doubling about every two years. Surprisingly, perhaps, this is roughly the same rate as the increase in the transistor count that has occurred over the same period, as predicted by Moore in 1965.

Since the Intel 4004, microprocessors have become a couple of million times faster



six years later, the 4004 was fabricated using a 10 micron process. Given that a human hair is about 100 microns in diameter, this sounded pretty small at the time, although that exponential decrease has made feature sizes a whole lot smaller over the years and decades. Today's 14nm chips have linear dimensions around 700 times smaller or, in terms of their area, features have shrunk by a factor of about half a million. This resulted in an increase in clock speeds from 108kHz in 1971 to 3.8GHz in 2004 but, since clock speeds have been pretty much

static ever since, it might be puzzling just why the race to produce ever smaller chips continues.

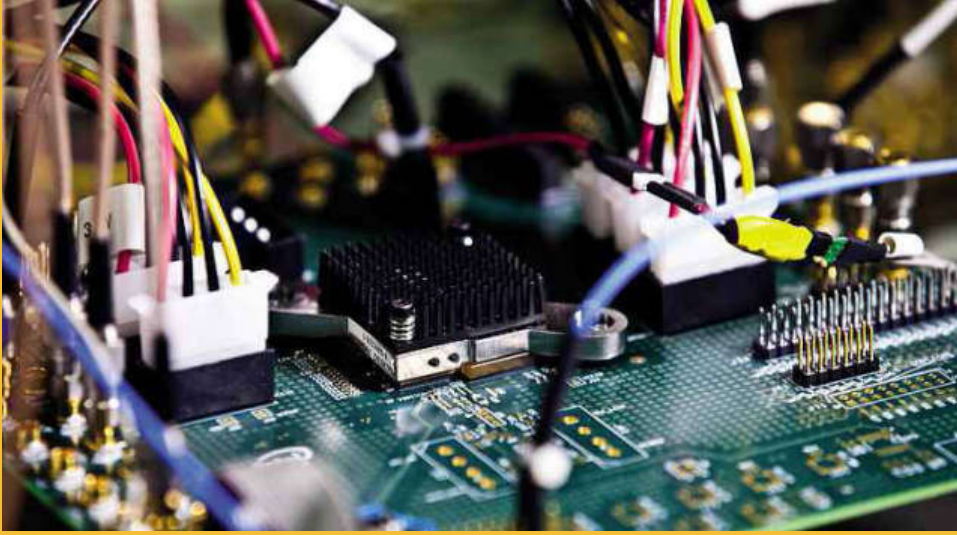
For many years, shrinking chips allowed a lower operating voltage to be used which, in turn, kept the power consumption constant even though it also permitted the clock frequency to be increased. As we'll see when we look at operating voltages, though, this particular benefit of ever smaller chips has pretty much run out of steam. However, there's one more benefit – one that's been central to Moore's Law and, while it continues today, it might

Experts are divided on just how much further manufacturing processes can be adapted to bring us yet smaller feature sizes

The story of why clock frequencies plateaued is well known. As increases in clock speed brought about corresponding increases in power consumption, further increases would have made processors too power hungry and a nightmare to keep cool. It's testimony to the resourcefulness of the semiconductor industry that even though one of the main drivers of increased performance was no longer available, new technologies such as multiple cores kept the trend of ever greater performance on track.

GHZ?





A trend for many years, Dennard Scaling ended a decade ago and voltages are now about as low as the laws of physics allow

just be approaching the end of the line. The very first benefit we saw of reducing the feature size was to keep the size of the chip in check, even as the number of transistors grew exponentially. Although we suggested earlier that this was due to the impracticability of using unfeasibly huge chips, economics is also a vitally important consideration. Given the huge cost of setting up a semiconductor fabrication facility, getting the maximum functionality from a chip and hence the best possible price is essential. Shrinking the size of transistors, and in so doing increasing the number you can cram on to a chip for a similar amount of work, has been a perfect way of doing exactly that.

PRICES IN FREEFALL

None of the trends we've investigated in this article would have taken place had it not been for the laws of

economics. Without year-on-year decreases in the cost of electronics' most basic building block, the transistor, the exponential increase in their numbers that we've witnessed would have been unsustainable and computers would have remained the domain of the few, as some basic calculations will show.

Without decreases in the cost of transistors, the exponential increase in their numbers we've seen would have been unsustainable

In a recent speech, Gordon Moore said his law has another 10 years to run, the same as he predicted in 1965

Despite its apparently lacklustre specification and performance, the 4004 wasn't exactly cheap when it was launched in 1971. It had a 4-bit architecture, it was clocked initially at 108kHz, rising eventually to 740kHz, it could address 32K of read-only memory but just 640 bytes of RAM. To do this, it used 2,300 transistors and cost around \$200. Although 10 transistors per dollar was cheap compared to several dollars for standalone transistors, a doubling in the transistor count every couple of years would have resulted in processor prices breaking the \$4,000 barrier before the end of the decade. And that doesn't even take inflation into account. By way of contrast, today's integrated transistors are priced in the hundred-thousandths of a penny.

The upshot of all this is that one exponentially increasing trend – that of the number of transistors per chip – has been more or less offset by an exponentially decreasing trend: the cost of those transistors. As a result, another trend – the cost of a microprocessor – really isn't a trend at all. So, from that \$200 in 1971, which probably worked out at around £1,100 here in the UK when historical exchange rates and cost of living differences are taken into account,

today's desktop processors range from around £80 to £900. Given that all our other trends have considered the most, the smallest or the fastest available on any given date, as our price for today we really ought to pick the latest and greatest, in which case prices have changed little over the whole era of the microprocessor.

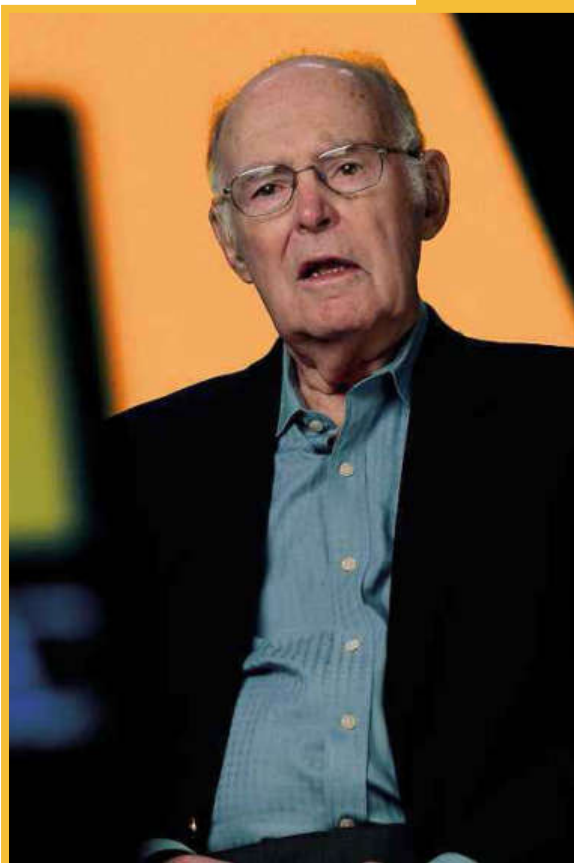
If you want ever more bang for your buck, all this is good news. According to some experts, though, things are about to change. While it's still business as usual for increases in transistor count, reductions in feature size, improvements in processor performance and so much more, some industry experts are suggesting that the cost of producing a transistor can't fall much further. Essentially it's getting so fiendishly difficult, and hence costly, to shrink feature sizes yet further. Indeed, it was a surprise to many when Intel confounded these analysts by reducing the cost-per-transistor in migrating to 14nm. Similar concerns are

being expressed about the transition to 10nm, due in 2017, and particularly the 7nm process, for which it appears that it will be necessary, at long last, to abandon silicon technology in favour of a different semiconductor. It remains to be seen just how far this particular trend can continue.

VOLTAGE REDUCTION

Alongside all the trends we've seen so far, another trend has gone largely unnoticed to the lay person but has been no less important in bringing us to where we are today. That trend is a reduction in the processor's operating voltage and, unlike the other trends, this hasn't plummeted exponentially but much more gradually. What's more, it's pretty much gone as low as the laws of physics allow.

We've seen how shrinking the feature size keeps chip sizes to manageable proportions, even as transistor counts increase, it reduces the cost per transistor and, for many years, it allowed clock speeds to be increased. It also allows the operating voltage to be decreased and, since the electrical power consumption of a chip is related to the square of the voltage, this can bring about huge gains. In fact, for many years this effect cancelled out the increase in power consumption



Moore's Law beyond electronics?

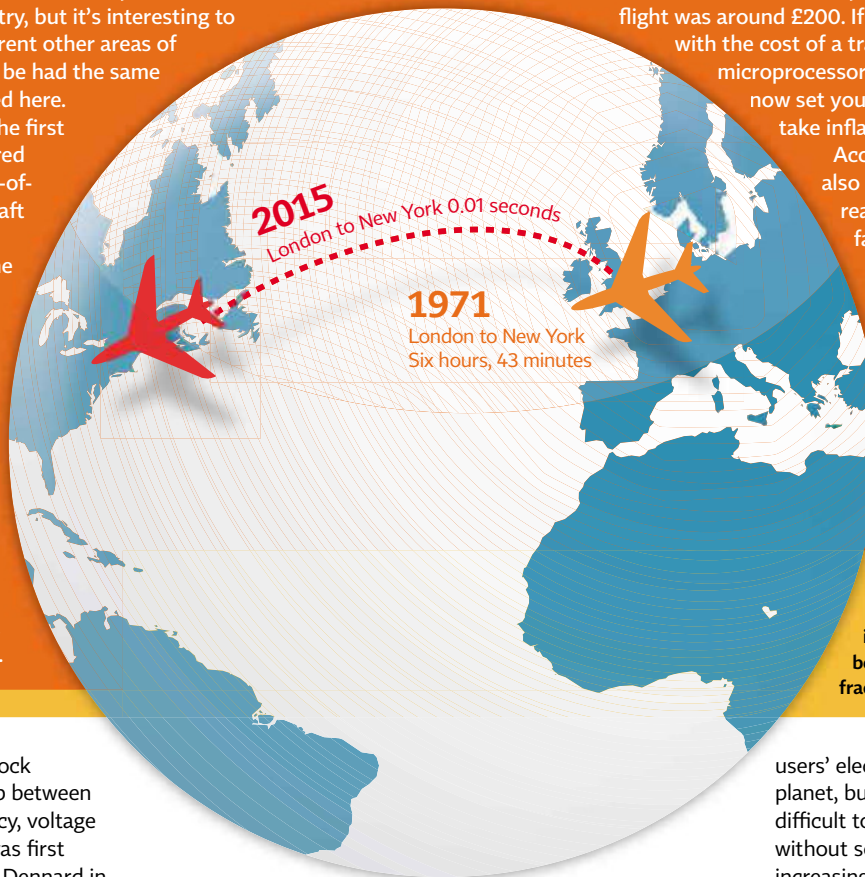
Ever smaller, cheaper and faster may be the norm in the microelectronics industry, but it's interesting to speculate on how different other areas of 21st-century life would be had the same sorts of trends occurred here.

Back in 1971 when the first microprocessor appeared on the scene, the state-of-the-art passenger aircraft was the Boeing 747. Otherwise known as the jumbo jet, which had made its inaugural commercial flight a year earlier, it crossed the Atlantic from London to New York in six hours, 43 minutes. Had the speed of aircraft increased at the same rate as silicon chips, we'd now be whisked across the Atlantic in a hundredth of a second.

Back then, the cost of an economy class return trans-Atlantic flight was around £200. If prices had fallen in line with the cost of a transistor in a microprocessor, the same flight would now set you back 0.1p, even when we take inflation into account.

According to Intel we can also apply this sort of reasoning to the size of a family car. Miniaturisation at the same rate as we've seen in the world of microprocessors would, by now, have given us the ant-sized car. We remain to be convinced this would have been as popular as faster and cheaper air travel, though.

Had aircraft development paralleled that of the integrated circuit, we'd now be crossing the Atlantic in a fraction of a second



caused by the increased clock frequency. The relationship between feature size, clock frequency, voltage and power consumption was first examined by IBM's Robert Dennard in 1974. It's referred to as Dennard Scaling and can be thought of as a law that fuelled Moore's Law for many years.

In the early days, integrated circuits such as the first logic chips and Intel's first memory devices operated from a 5V supply. Being a very early adopter of MOS technology, the 4004 microprocessor had a 15V supply, although it wasn't long until the teething problems were sorted out and a 5V supply became the norm for microprocessors. In fact, that 5V supply remained the de facto standard for several generations, presumably because there was no real imperative to upset the status quo, given the still low transistor count and clock speed.

In time, though, lower voltages were introduced. As 3.5V and lower voltages appeared for some of the 386s, 486s and Pentiums, and the Pentium Pro used a reduced voltage for all its variants, this trend gained momentum, but only in ever decreasing steps; a far cry from the exponential trends we see elsewhere. Today the minimum is around 0.75V, but it's becoming increasingly difficult to quote exact figures for recent designs since different parts of the chip can operate at different voltages.

The physics might be involved but the conclusion is clear: there's a limit to how low you can go. So, 30 years after Dennard published his paper on scaling, and 20 years after the semiconductor industry first started to embrace it, Dennard Scaling came to an end. This happened around 2004, when Intel was trying to create a 4GHz Pentium 4. Since the higher power consumption brought about by a higher clock speed could no longer be mitigated by a lower voltage, chips started to become seriously power hungry. Not only was this bad for


Would Moore's Law have been proved right without the might of Intel, the company he co-founded?



users' electricity bills and for the planet, but it became increasingly difficult to keep processors from frying without some serious cooling. Ever increasing clock speeds became a thing of the past, heralding the era of multicore processors.

INTO THE FUTURE

The most obvious way to draw our investigation of Moore's Law to an end is to address the question of how much longer we can expect it to stay on track. But since this question has been raised ad infinitum whenever problems have loomed, let's just say that the man himself recently gave it at least another 10 years, the same period he suggested half a century ago.

Perhaps a more telling conclusion would be to quote Moore in a recent interview with the Chemical Heritage Foundation. Intriguingly, rather than a prediction, he now views Moore's Law as a self-fulfilling prophecy. "Gradually, it became something that the various industry participants recognised as the pace of innovation they had to stay on or fall behind technologically. In order to stay at the leading edge where most of the advantages of semiconductor technology get exploited, they had to move as fast as Moore's Law predicted. So Moore's Law went from a way of measuring what had happened to something that was kind of driving the industry." 

SMART HOME CONTROL

DOORS
LOCKED

FREEZER
DEFROSTING

ALARM
FAILED

FUSE
BLOWN

REBOOT
HOUSE

72°C





Where's my smart home anyway?

Is the Internet of Things all hype? **Nicole Kobie** explains why smart homes and other connected gizmos are struggling to capture the imagination – and purchasing pounds – of consumers

The promise of the Internet of Things (IoT) and smart homes is glorious: a life of leisure enabled by the tech equivalent of a house staff straight out of *Downton Abbey*. A revolution in home convenience unmatched since the heyday of consumer home appliances in the 1950s.

Imagine it: no need to call your family to tell them you're heading home from the office: your car will ping them when you get behind the wheel – and take over the driving when you hit the motorway.

As you arrive, the lights turn a warm glow to welcome you and the door unlocks without any fumbling for keys. A digital voice says 'hello' as you step through the door, and asks if you'd like to play your favourite album. Dinner is suggested by your fridge – it tracks when food is about to go off, so it's eaten while still fresh – and cooked by your oven in a recipe downloaded from the internet.

The dishwasher automatically turns on at 1.43am, precisely the time when energy prices are lowest and the noise is least likely to disrupt your sleep, which is in turn measured by the wearable on your wrist that awakens you the next morning at just the right time in your sleep cycle. That watch alerts the coffee machine that you're awake so your morning cup is ready when you step into the kitchen, which is warmed to a perfect temperature by the smart thermostat that takes into account how sunny it is, and turns itself down in advance of the warming sun streaming through the windows.

Smart homes could be like having a cloud-based butler who attends to your every digital need – but there are downsides that could keep this tech convenience utopia from becoming a reality.

All the technologies mentioned exist in some shape or form already, though they may be a few years away from commercial availability. But while the technology may be in place, other challenges remain: many consumer IoT devices aren't yet actually very useful, especially given their high price, while the classic IT issues of compatibility, security and privacy are exacerbated by the always-connected sensors collecting data on everything we do. In other words, smart fridges are expensive, smart cars are hackable, and connected home helpers extend surveillance into our living rooms, kitchens and bedrooms.

Such challenges aren't expected to hold back the IoT. Industry analyst Gartner is predicting there will be 4.9 billion connected devices chatting to each other and to databases this year, leaping to 25 billion within five years. While much of that will be business uses, consumer IoT will make up half of those devices by 2020, Gartner believes.

But will the IoT succeed with consumers? Will our homes become truly smart, will we have a few intelligent connected devices, or will we merely have an extra handful of gadgets cluttering up our shelves? These are the challenges the IoT needs to overcome to find a place in our homes and our lives.



Product problems

Setting aside for a moment the other challenges the IoT must overcome, smart home kit has to perform one particular role above all: it has to do something truly useful.

Look at smartphones. They're now ubiquitous, despite compatibility issues, potential security flaws and privacy concerns. But who cares if you have to choose between iOS and Android, if it means you have a map of the world with directions to everywhere in your pocket? So what if cybercriminals and governments are targeting handsets, if we can

but a yet-to-be-issued update was required for specific smartphones – a point not noted on the product's packaging.

Other smart home gadgets weren't as smart as we'd hoped. The Netatmo Welcome camera's facial-recognition feature means it can tell when an unrecognised person enters a room. Image quality is fantastic and setup is simple, but the key selling point of automated recognition identified our microwave as a human face (possibly foreseeing an appliance uprising) and still gets confused by different hairstyles and glasses. Not so smart, then.

A starter kit for smart lights costs £60 – you need to really hate flicking the light switch to invest in that

have access to all our music, games and the entire internet everywhere we go?

Convenience is one heck of a selling factor, but many IoT devices are niche compared to the modern Swiss Army knife that phones have become – and their high price means it's costly to get the benefits they do offer.

Look at Belkin's Wemo lights. Plug a Hub into the wall, screw in a smart bulb, and your light can now be controlled from a phone. A starter kit costs £60 – you need to really hate flicking the light switch to invest in that.

There are other issues aside from price. We spent a solid hour trying to make a Belkin Wemo smart switch work with a Motorola phone, but it was impossible. It worked with an iPhone and an alternative Android handset,

What's the use?

And these are some of the more worthy examples of home IoT. Others simply aren't worth the cost or trouble for the small benefit they bring. Parrot's FlowerPower plant monitor issues notifications for water levels, but only if you're in Bluetooth range, as it doesn't support Wi-Fi. It also can't recognise the plant's variety to decide the right moisture level – and you still have to do the watering yourself (for now, at least; a new version will water them too). For £50, you have to do all the work yourself. What's the point of that? Unsurprisingly, our test plant shrivelled and died.

Of course, some consumers may find these products useful. Thanks to the IoT hype, developers are shoving connectivity into all



The simplest IoT products are often the best, such as this network-controlled plug socket adaptor

sorts of products: Drop is a connected kitchen scale (£80); June is a smart bracelet that tracks sun exposure (£80); and Darma (£130) is a smart cushion that helps your posture. If it's a thing in your house, someone has tried to connect it to the internet.

Those could all be useful to someone, and aren't the silliest by far – see 'The Internet of Useless Things' (opposite) for proof of that – but many are niche devices that may appeal to a few, but never break through to the mainstream. Crowdfunding sites Kickstarter and IndieGoGo are full of such gadgets, but the most popular smart home products remain thermostats and security devices, the only proven product categories to date.

That's a lesson learned the hard way by Indian entrepreneur Yash Kotak. While he now runs startup FundaMine, his last project was the Lumos switch, a smart controller for lights. He shut it down in 2014. "The value that Lumos switches provided did not justify the cost the target customer had to pay for it," he said. "Because we couldn't find a way around this, we shut down the project. Turning lights on with a smartphone is cool. But it does not add enough value. Party tricks won't sell."

He believes more IoT devices will fail for the same reason. "Other products are facing such problems. The cost of IoT hardware products is too high right now," he said. "The value-pain equation for your product should make sense for your target customer. Unless value [is more than] pain, your product will not sell."

That doesn't mean startups should leave IoT devices to big players, though. "Just build something that's not only cool but also provides value," Kotak said, pointing to Nest and DropCam, two startups bought by Google.

Google was wise to choose the smart thermometer and security camera firm, noted Berg Insights analyst Lars Kurkinen. "In smart homes, it is especially smart thermostats and security products such as home alarms and home surveillance systems that are the big sellers today," he said, and that's little surprise given the utility offered by both.

The number of homes with smart thermostats made by the likes of Nest, Honeywell and Hive grew by 96% last year,

↓ It looks great, but a problem with any of these devices could ruin your day



Quiz: the internet of useless things

While the IoT is being touted as a way to deliver medical services in-home, cut traffic and reduce energy use, some product developers have less high-minded aims. To mock the silliest smart devices, design consultancy RehabStudio set up its Internet of Useless Things website, mocking up fake products that are a step too silly to be real. Or are they?

Here are 10 IoT creations – can you tell which are real and which are RehabStudio's fakes? Answers at the bottom.

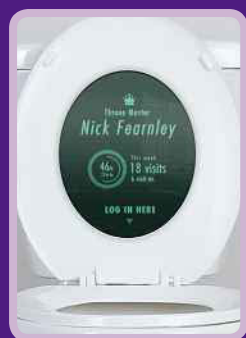
EGG MINDER

There's nothing worse than craving a fry-up for breakfast, and opening the fridge door to find you're out of eggs. That's the premise of the Egg Minder, a connected tray that lets you know eggsactly – yes, we went there – how many eggs you have left, so you never run short.



HAPIFORK

This smart fork tracks your eating rate, vibrating if you eat too quickly to let you know when to slow down and chew your food.



THRONE MASTER

Everything can be turned into a game – even your toilet. That's the idea behind Throne Master, which tracks your daily movements, ranking everyone in your household so you can see who has the most, er, output.



VESSYL

It's not only cutlery getting smart: this clever cup tracks what you drink, calculating calories, caffeine levels, your hydration – and even telling you what you've poured in, just in case you weren't aware.

CH4 TRACKER

Slip this sensor into your back pocket or attach it to your belt. From that handy position, it tracks your emissions to see which foods create the most gas in your body.



SMARTPLATE

Why guess at the calories in the food in your plate? SmartPlate analyses your meal, using three cameras and weight sensors to identify your food and tot up the calories. The data is uploaded to the cloud so you can track it all.



BOOKMKII

Tired of losing your place when reading? Tuck the BookMKII into your novel's pages, and it calculates your place and sends it to the cloud to be stored, with page number updates sent over SMS.

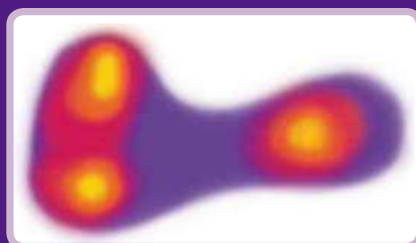


IBLIND

The problem with window blinds is they block the view, so you can't see when it's time to open them back up. These window coverings track the brightness outside, displaying it on the blinds, so you know when's the right time to roll them back up.

SENSORIA SMART SOCKS

Designed for runners, these smart socks analyse your gait to help you improve your form and avoid injuries using textile pressure sensors that create a heatmap of your foot.



FITSPOON

This connected cutlery tracks how quickly you're eating, comparing your stats to a database in the cloud. If you're shovelling in dinner too quickly, small holes open up in the spoon, releasing its contents and forcing you to slow down.



with Berg Insights predicting such growth will continue because they're genuinely useful for consumers by helping them save money. They're also good for energy companies who have a remit to reduce power usage and also want more data on when and how energy is being used.

Those are much bigger selling points than a Bluetooth notification that a geranium has a 23% water level.

Working together

Even if devices do actually work, they often don't work well together. The Internet of Things isn't just supposed to let us talk to devices, but to let them talk to each other – indeed, the idea has previously been known as machine-to-machine (M2M).

The problem is most devices aren't capable of sharing the data they collect and telling each other what to do about it. It's an IT problem as old as the industry: interoperability. There are efforts to solve the problem. Tools such as If This, Then That (ifttt.com) make it easier, acting as a link between devices that don't actually communicate. You can, for example, make a 'recipe' to turn up your heating if the outside temperature falls. Your smart temperature gauge uploads its measurements to cloud-based servers, IFTTT reads the data, and triggers your smart heating system.



◀ Nest's Smart thermometer is a rare IoT hit

Lars Kurkinen. "This is not only a barrier for consumer adoption, it is also an issue for product manufacturers. Currently, product manufacturers need to develop several different versions of the same product in order to ensure compatibility with the widest possible range of smart home systems."

There's a (smart) light at the end of the tunnel, however, though it comes with an existing tech divide. Apple's HomeKit and Google's Brillo are software platforms that look to put the smartphone at the centre of consumer IoT, making it easier for devices from disparate developers to connect and share data, and for users to manage them. "Apple's and Google's entry will accelerate the consolidation towards a few leading interoperability standards, which benefits the market as a whole," said Kurkinen.

Smart home devices from Apple started to arrive this summer, though many remain US only. There's the ecobee smart thermostat, iHome smart plugs and Elgato Eve, a wireless sensor to monitor air quality and temperature, with more products expected later this year. Google's Brillo smart home platform was announced only this summer and products

Smart home kit we love

While we remain unconvinced by smart egg-holders and plant monitors, there's a host of well-made and truly useful connected home kit on the market. Here's our pick of some of the best. And if you're looking for something more integrated, see Samsung's SmartThings on page 108.

Nest Protect (£109)

★★★★★

Google's purchase of Nest pushed its smart thermostat into the IoT limelight, but it wasn't available in the UK until recently. Instead, the company's first product to hit these shores was the Nest Protect, a smart smoke alarm. Not only does it send alarm and low-battery alerts to your smartphone, but it's easy to turn off when burnt toast is the problem, rather than a real threat. If you also have a Nest Thermostat, they can work together to turn off your boiler if a CO₂ leak is detected.

tinyurl.com/protectreview

Philips Friends of Hue Iris and Light Strips

(£110 and £70) ★★★★★☆

If you want to take control of your home lighting, the Philips Hue system is an easy, albeit fairly expensive, way to do it. The Light Strips are a roll of LEDs that are easily installed thanks to adhesive tape on the back, letting you add swish-looking lighting anywhere – under cabinets, along the edge of a mirror, or around a media centre. The Iris is a smart lamp: you simply plug it in and connect it to Hue's hub bridge. You can control the colour of the light with both of these, letting you set the ambient mood to your tastes.

tinyurl.com/huereview



Honeywell Evohome (£249) ★★★★★

Smart heating controls were the first success for the IoT in homes, led by Nest and Hive. Honeywell's Evohome takes it a step further. Not only can you control your thermostat and timer, but you can treat each room differently, letting you heat each room in the house when you need it, exactly how you want it. Installation may require a professional, as it connects all aspects of your heating system via a wireless relay, but you'll be able to warm your bedroom before you wake up, cool your bathroom during the day when no-one's home, but keep your living room cosy throughout the day for your pets.

tinyurl.com/honeywellreview



haven't yet hit the shelves, but one of the first will be Google's own OnHub, a smart router that will eventually act as the connectivity hub for smart homes, linking up devices and letting them interact.

Amazon is also making a play for the smart home. It has launched internet connected buttons that let you add items to your Amazon order from anywhere in the home, such as a Gillette button that sits beside your razors in the bathroom. There's also the voice-activated assistant Echo. Essentially Cortana or Siri for your living room, you can ask the Amazon Echo's voice assistant Alexa any question, tell it to stream a playlist, and – this being Amazon – make a shopping list. The Echo can also be set up as the centre of a smart home via the Alexa Skills Kit, a set of APIs Amazon released in June.

Will Google, Apple and Amazon dominate the IoT as much as they have the web? It's hard to imagine they won't, but even if they sort out interoperability within their own platforms, there's still two more challenges none of those firms has yet to solve completely: security and privacy.

Keeping it secure

The headlines are horrifying. Researchers take over a connected car, turning off the brakes while a journalist careers down a motorway. Creeps crack internet-connected baby monitors, screaming at small children. And everything from smart TVs to lighting and toilets have been found to hold security flaws.

Many of the biggest such hacks have been research projects by so-called white-hat hackers working with the industry, rather than actual criminal activities. Still, that doesn't mean IoT is insecure in theory and safe in reality. "They have identified more problems in terms of the breadth of IoT devices than there have been abuse cases, but that cannot downplay the impact when a single insecure device may be abused by criminals and impact tens or hundreds of thousands of consumers," said Mark Stanislav, senior security consultant at Rapid7. "The problem is, however, that the pace of IoT growth makes it hard to imagine security researchers being able to sustainably outpace criminals."

That's why high-profile hacks such as those against connected cars are so important, he argued. Charlie Miller and Chris Valasek are infamous for hacking multiple smart cars, and such behaviour recently won the researchers a job with Uber. Earlier this year, they showed noticeable glee as they took over a Jeep while it was being driven down a motorway by a nervous journalist, messing with everything from the radio station and air conditioning to windshield wipers and transmission, cutting out the accelerator.

"This example shows what happens when

Smart home buying advice



We ask the experts what to look for when shopping for smart home devices

- **Do your homework** "While shopping for IoT products on Kickstarter, consumers should do a background check on the ability of the team to execute," says FundaMine's Yash Kotak. "The team should have people who have experience of building market-ready hardware products as well as connections in China."
- **Think it through** "Like any technology, I recommend that consumers weigh the potential risks and rewards before purchasing a device," says Rapid7's Mark Stanislav. "For instance, I have a web camera in my home, but only in my living room – for me, that provides a good deal of assurance that my home is safe without impeding too much of my privacy if it were hacked. Each device should have this process carried out for a consumer's risk tolerance, and you should make a decision that's right for you and your family."
- **Be patient** "I don't buy first-generation products, but that's just me," says F-Secure's Sean Sullivan. "I don't like unreliable gadgets. I trust that anybody seriously shopping for smart home devices at this time is willing to pay the early adopter tax."
- **Get the right hardware** "Pay for a good router," adds Sullivan. "If you haven't bought one in a while, then update or upgrade. And then take the time to lock it down. It will be worth the investment and time."

KICKSTARTER

Many IoT devices come from untested teams on Kickstarter

connectivity enters our physical world and can directly impact our safety, rather than just imply inconvenience to us or reduce our privacy," said Stanislav. "While any abuse of a person's property or life is horrible, the research they performed will hopefully serve as a catalyst for change in the automotive industry and will prevent real harm coming to real people. That's important."

As terrifying as the stories are, it's difficult to say if security flaws and high-profile hacks are enough to dissuade shoppers – it's worth remembering that hacked affair website Ashley Madison has added users since it was attacked – though larger firms are less likely to get punished for missteps than smaller startups, said Stanislav.

"Whether it's a stolen credit card, stolen personal information, or worse, we see

consumers return to brands they trust, regardless of security history, which brings significant questions around what constitutes brand loyalty," Stanislav said. "This is a challenge for lesser-known brands or startups, however. Companies in the IoT market segment or product space, which has publicly experienced security issues in the past, are facing consumers that are less willing to take risks on relatively unknown brands."

Cramming connectivity into everything we own will naturally lead to security challenges, but they aren't necessarily insurmountable. At the moment, not enough work is being done to build security – or privacy – into such devices. F-Secure security advisor Sean Sullivan believes it's a matter of cost. "IoT devices will only be secured as much as they need to be to exist on the market," he said.

"It's up to consumers to demand more than a low bar. Active exploitation in the wild might force improved security, or then it might just kill or suppress the home IoT market."

Security need not be expensive or complicated. "A television with a built-in camera would be a great way to chat to my mother and son," Sullivan noted. "But such a TV had better include a manual cover for that camera lens if it expects to find a place in my future home."

Some effort is being made to build security into the IoT, and



that includes BuilditSecure.ly, a group co-founded by Stanislav that helps developers get in touch with security researchers who will do pro bono work to 'sanity check' devices before they're sold to consumers. "Many IoT vendors don't have a dedicated security team or even person on staff, which hurts their ability to leverage these initiatives," he said. "Especially for smaller organisations, security expertise is often an afterthought, leading to many of the issues we see come to market."

If you're shopping for a smart home device now, be aware of that. "Participation in these nascent years of IoT does come with some risk, no matter how large or small the brand," said Stanislav. However, it must also be noted that such criminal activity follows the money, and there will need to be a clear profit stream before serious work is undertaken by hackers to undermine your IoT devices.

Privacy concerns

Do people care about privacy? The surveys suggest they do: research by security firm TRUSTe in 2014 suggested only 22% of people think the benefits of smart devices outweigh

Things your smart home won't do ...

- ✗ Put your clothes in the washing machine
- ✗ Empty your bins
- ✗ Clean your bathroom or your oven
- ✗ Clean out your gutters
- ✗ Iron your shirts

privacy concerns, and one in eight want to know more about the information being collected – and want to control their own data. That could suggest people won't let smart devices into their homes, though it might just be that the perceived benefits of smart devices aren't yet apparent enough to be worth any risk, however small. Either way, smart devices will need to convince consumers they aren't a privacy risk.

Such privacy concerns certainly aren't unwarranted. Your smartphone has the

potential to know exactly where you go, what you do and what you buy, but smart home gadgetry can extend that data collection to inside your home, revealing what you eat, when you're in the house, and other intimate details about your home life.

"The biggest privacy concerns with the IoT are, as far as I'm concerned, that the kinds of data gathered are new, and directly connected with what we do in our ordinary lives," said Dr Paul Bernal, a lecturer in IT and privacy at the University of East Anglia. "We're not used to the idea that people might know this kind of information – and haven't even really considered what they might do with it."

Bernal said car manufacturers, for example, could use driving data to improve how vehicles work. While we might approve that use of our data, if insurance companies could also access it, they could use that information to increase premiums. What if a smart home device reveals to your employer that you're not working from home as you're supposed to be? Or if a service is hacked and reveals an embarrassing habit? Anyone who signed up for affair website Ashley Madison will know that feeling.

Samsung SmartThings

A connected home in a box

Samsung paid \$200 million for Silicon Valley startup SmartThings last year, but the second-generation Samsung-approved smart home line-up is only just hitting the UK now. And it's just the sort of connected kit that might break the IoT out of its current malaise.

SmartThings is an expandable kit designed to network your appliances, lightbulbs and other smart gadgets to one central hub, giving you control over everything from an iOS, Android or Windows Phone smartphone.

The SmartThings Hub will be available for around £99 separately, or as part of the (estimated) £199 Starter Kit. It plugs into your router and interacts with smart appliances and sensors in your house, whether they're part of the SmartThings range or not. It supports protocols including Zigbee and Z-Wave, meaning brands such as Philips Hue lightbulbs, Yale smart locks and D-Link security cameras are all supported, and the company has suggested Bluetooth control may be possible in a future firmware update.

It draws power from the mains, but in the event of power failure it has four AA batteries that can keep the Hub up and running for up to 10 hours. It's still unclear whether there will be any kind of mobile data backup too, as is the case in the US. Two USB ports on the back are ready for expansion in the future, which should mean there's no need to upgrade to a brand new Hub.



Because of a few last-minute changes and bugs Samsung hasn't revealed the final SmartThings app, but having seen a prototype in action, it's clear the system has real potential. With a simple layout, no-jargon descriptions and easy-to-create IF/AND rules, it shouldn't take more than 15 minutes to set up motion-controlled lighting, notifications when the kids come home from school, or a boiled kettle first thing in the morning.

You can schedule different automations on different days, stack actions using sensors and control third-party devices directly, with no need to open a second app to change the colours of a Philips Hue lightbulb, for example.

There's already a growing range of official SmartThings sensors, five of which will be

available in the UK at launch. The Presence sensor (£30 SRP) is a tiny tag designed to fit on a keychain or pet collar; it recognises when someone arrives or leaves the house, and creates actions accordingly. If you like the idea of automatic lighting, heating or music when you get home from work, you won't need to buy one of these for yourself, as your phone also acts as a presence sensor.

The Motion and Multi sensors (£30 each, SRP) are designed to keep you informed, by sending messages when someone walks into a particular area, for example, or if a door is opened at a certain time of day. The Motion sensor can be used to trigger lights too, so you won't need to turn on a light switch when going to the bathroom at night. Both have

"I don't, however, think this is on everyone's minds yet – we still like cool gadgets more than anything else, and the privacy implications haven't yet become clear to everyone," Bernal added. "The Ashley Madison hack may be another step towards this understanding – people need to be shocked into understanding, I think."

On top of selling the data on to third parties such as insurers or it being hacked by criminals, the IoT could also give government spies another way to snoop on us, Bernal noted. "I'm afraid the IoT is almost certain to become another layer in the surveillance infrastructure – much of what makes it work is about surveillance," he said. "It monitors. It watches. It analyses. That's the point of it, really – the question is whether we put appropriate controls in place to make that surveillance more beneficial than damaging."

Knocking down hurdles

Despite such challenges, tech companies clearly believe the IoT and smart homes are the next big thing – everyone from Apple and Google to Amazon and Microsoft is getting behind the hype. Whether consumers buy into



The Netatmo Welcome camera is designed to track who's entering your home

it is another question. "I'm not sure the IoT will be quite as big as the tech companies expect, but I think the jury's out on that," said Bernal. "It may become something we just accept as part of the way things work."

Rather than an overnight IoT revolution, then, it's more likely that smart home tech will slowly creep into our lives, as the challenges outlined here are whittled away – or we become so used to the conveniences that we ignore the downsides.

While some smart home tech will arrive via individual devices, F-Secure's Sean Sullivan predicted that new-build houses will be where

it really takes hold. "Currently, there are folks upgrading their existing home and that's a niche," he said. "I think general consumers just want stuff that works and real growth will come once home-builders start to offer fully integrated systems."

Either way, the change will be gradual, said Lars Kurkinen. "It starts out with bits and pieces of smart technology that consumers take into use when they find it personally useful," he said. "Over time, all the connected devices in the home will be able to communicate with one another to create a truly intelligent home that serves the user in a wide variety of ways, many of which we have not yet imagined."

That smart home utopia of a world full of conveniences may well happen, but it might be a long process to get there. The foundations will need to be sound, without having too many competing platforms and standards. It will need to be secure, so we're not invaded by undesirable elements. And we'll need transparent control of our privacy, so we know just what we're sharing with the Googles of this world. In short, let's get our cloud-based butler just right before giving him the keys to our cars and homes. **CS**

The presence sensor lets the system know if you're at home



integrated temperature sensors, which can be used to set up actions, but the Multi also has vibration and orientation sensors, making it ideal for alerting you when someone knocks on the door, or for checking whether you shut the garage door in your hurry to leave home in the morning.

The Moisture sensor (£30 SRP) was built solely because the company founder suffered a burst pipe while he was away from home for the winter; it immediately alerts you if any water is detected, helping you prevent serious water damage from broken water fixtures.

It's the Outlet adaptors (£45 SRP) that could prove most useful, however, letting you control individual plug sockets remotely. You can run power on a schedule, in order to create the appearance of someone being home while you're on holiday, or to boil a kettle the moment you get home at night. Each Outlet adaptor also monitors energy usage, reporting power draw through the app.

You get one Outlet, one each of the Multi, Motion and Presence sensors, and a Hub in the Starter Kit. Each SmartThings sensor

takes CR2450 watch batteries, which should last up to a year based on average usage, although this is apparently a conservative estimate; depending on how often each sensor is triggered, it could be two years before the app warns you it's time to replace the batteries inside them.

While SmartThings looks comprehensive, there are one or two omissions. There's no light sensor, although the system tracks sunrise and sunset times and third-party sensors are available for anyone looking to open curtains automatically or twin with motion detectors for automated lighting.

More troubling is the lack of a smart light switch. Samsung clearly wants SmartThings to be an out-of-the-box upgrade, rather than something you have to break out power tools to install, but currently this means leaving your lights on all the time and controlling them solely from the SmartThings app.

Unless you plan on putting Z-Wave or Zigbee bulbs in every room, and don't mind scrambling for your smartphone every time you want to turn on the light, there's no way

to control ceiling-mounted lights. Each smart plug costs an estimated £45, which would be an expensive alternative.

Samsung and SmartThings are working to close those gaps, however, and are beginning to look elsewhere for ways to automate your life. A prototype pressure sensor, designed to fit under a bed and measure heart rate, track sleep and trigger actions when you wake up in the morning was shown off, although it isn't yet ready to go on sale. Hopefully this is a sign of things to come, with the company closing the gaps in its range while continuing to support third-party devices.

Individually, SmartThings sensors look expensive, but as a starter kit that doesn't require any rewiring or monthly fees, there's definitely an appeal to a one-box system. Samsung SmartThings is available now from Currys, PC World and Samsung's own online store. We'll be putting the system on test soon, so stand by for a full review.



Motion and Multi sensors can act much like traditional security devices



The **RISE** of **Ultra HD**

It promises sharper images than ever before, but what exactly is Ultra HD? And how can you get it? Our in-depth guide reveals all

WHILE WE'VE HAD 4K cinema for years now, the technology has been a little slower entering the home. With prices of TVs dropping and more content becoming available, 4K (known as Ultra HD in the home market) is set to take off in a big way soon. But what does it really do, why should you care and where can you get 4K content? Here, we'll explain everything and show you why, if you don't have one already, you'll want a 4K TV.

Ultra HD or 4K?

The terms Ultra HD and 4K have been used interchangeably, with the latter the more popular term. However, in terms of home entertainment, 4K is technically an incorrect term, as it refers to the cinema standard,

which has a resolution of 4,096x2,160 pixels. The home standard is Ultra HD, which has a resolution of 3,840x2,160 to match the 16:9 aspect ratio of TVs. For the purposes of this article, we're talking about Ultra HD.

What does Ultra HD give you that Full HD doesn't?

The simple answer to this question is more resolution. Full HD TVs have a resolution of 1,920x1,080 (a total of 2,073,600 pixels), while Ultra HD TVs have a resolution of 3,840x2,160 (8,294,400 pixels). In other words, Ultra HD TVs have four times the resolution of Full HD TVs, with each picture equivalent to a shot from an 8-megapixel camera. That's a massive increase in resolution, which means that with the right footage 4K TVs can show more detail than is possible with a Full HD TV.

A couple of images can help show the differences between the various technologies. First, the image (opposite, top) shows the difference in size between standards, starting with regular PAL TV at the bottom left and moving up to Ultra HD. As you can see, Ultra HD is a huge jump from Full HD.

The problem with this picture is that it shows the differences between images when they're displayed at full resolution on a 4K TV. Obviously, in real life if you had a 4K TV and watched Full HD content, the image would be full-screen. A better comparison would be to look at Full HD and 4K TV at the same physical size, which we've done in the images opposite (below). These are frames pulled from the open-source film, *Tears of Steel*. For these comparisons, we downloaded the rendered frames from the 1080p and cinema



4K versions of the film. We then resized the cinema 4K to fit the Ultra HD standard.

When viewed at the same size, the Full HD version (left) is noticeably softer than the Ultra HD version (right). In particular, the Ultra HD version has much better skin texture and you can more clearly read the writing on the carton. You can argue that the differences are subtle, but the effect is greater when

watch content, with films traditionally shot at 24fps and UK TV at 25fps. With Ultra HD that changes, and the technology supports up to 60fps (UK TV will most likely come in at 50fps – double the existing frame rate). There may be some naysayers out there claiming that a higher frame rate makes footage look wrong and films look as though they've been shot on video, but they're wrong. The smoother

The smoother footage looks a lot better and removes any jerkiness from fast-moving scenes or panning shots

watching Ultra HD content: it looks sharper and, once you're used to it, Full HD tends to look soft. Resolution is just one aspect of Ultra HD, though, with the new standard making a few other improvements.

Colour and frame rates

One thing that hasn't changed with higher-resolution TV is the frame rate at which we

footage looks a lot better and removes any jerkiness from fast-moving scenes or panning shots. It's particularly useful in sport, as you can more easily keep up with the action.

Ultra HD also provides better colour depth, with support for 10-bit and 12-bit colour, rather than the 8-bit colour at the moment. That means a wider range of colours are available, which gives a more vibrant and

What about broadcast TV?

The obvious way to get Ultra HD footage is via a regular broadcast system. The DVD-UHD broadcast standard has been approved, but no Ultra HD TV has a compatible tuner, we don't have any compatible set-top boxes and not one UK broadcaster has committed to using the standard or launching a channel yet. The same goes for Sky, which has not committed to launching an Ultra HD service via satellite, either.

There are a few barriers to launch, including bandwidth limitations. While the broadcast Ultra HD standards use the HEVC standard, this currently only doubles the compression rate. As Ultra HD uses four times the number of pixels as Full HD, this means that you'll need at least double the bandwidth to deliver Ultra HD footage. In reality, it's likely to be more than double, as HD is broadcast at a lower frame rate and is interlaced (every frame gets half the number of lines); Ultra HD has a higher frame rate and every frame is progressive.

Bandwidth pressure could be eased if broadcasters could switch compression to use HEVC on all channels (an HD channel would require half the bandwidth), rather than H.264, but that would require every household to upgrade their existing equipment, so it seems unlikely. A more realistic scenario is that we'll start slowly, getting one or two Ultra HD channels, with additional content available to stream online. The BBC has already run several trials, as has Sky, so it doesn't feel as though we're too far away from a proper launch – we'll keep you posted.

Tears of Steel 1080p



Tears of Steel Ultra HD original frame



↑ Detail is close on both, but with Ultra HD you can see the writing on the carton more clearly, while the picture is much sharper than the Full HD version





realistic colour palette, and brings out subtler detail in images. There's also the promise of High Dynamic Range (HDR) footage.

What is HDR?

Dynamic range describes the ratio between the darkest and lightest shades of an image. Typically, an image or a film is shot with a relatively low dynamic range, which means you lose some detail in one part of the image. For example, you may have lots of detail in the shadows of an image, but little detail in the sky; conversely, shadows may appear black, while the brighter part of the image

may have lots of detail. With HDR footage, you get all the detail in the dark parts of the image and all the detail in the lighter parts of the image. We've seen this technique used in photography a lot, and now even most smartphones have an HDR photo mode; however, this is the first time that the process has moved into video. We've seen some test footage and it's looking stunning.

What about sound?

There's no maximum or minimum sound quality set in the Ultra HD standard, but you can get everything from stereo audio up to 7.1

lossless Dolby TrueHD and DTS-HD Master Audio soundtracks, depending on the source footage. In other words, you can get amazing sound, but the source of the footage defines the quality and type of soundtrack.

Doesn't Ultra HD footage take up lots of room?

You need a lot more storage space and bandwidth to deliver Ultra HD footage, but not as much as you may think. While current Full HD footage generally uses the H.264 codec, Ultra HD content is typically encoded using the H.265 codec, also known as High Efficiency Video Coding (HEVC). It needs a lot more processing power to deal with, but cuts file sizes down: it can make files roughly half the size as when using H.264.

Unfortunately, outside of computers, which have powerful processors and are easy to upgrade, HEVC support can't be added retrospectively to older products. That means, for example, that Ultra HD Netflix support can't be added to an older TV or media streamer except via an external box.

4K Blu-ray

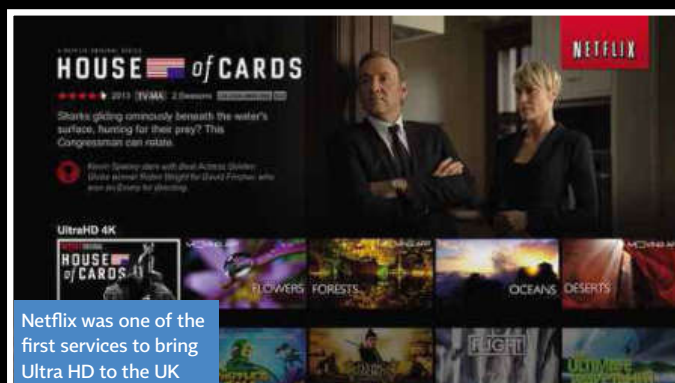
You may have seen that there are a growing number of Sony-produced Blu-ray discs that say 'Mastered in 4K' on them. Given that most films are shot in at least 4K, this sounds like common sense, but there are actually a

Where can I get Ultra HD content?

We've had the TVs and projectors for a while, but the content has been slow to come in the UK. Things are starting to improve, though, and there's now a range of decent content available for you to watch. We take you through all the options available now and coming soon

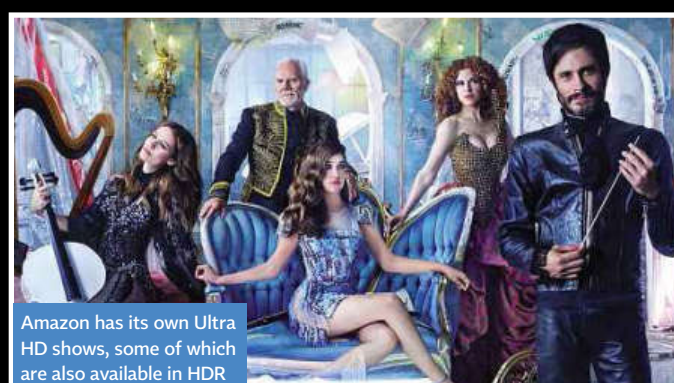


Netflix was one of the first adopters of Ultra HD, delivering its content over the internet. Its home-grown shows, such as Daredevil, are all shot and delivered in 4K, and it's starting to make other content, such as The Avengers, available. To get Ultra HD Netflix you need a TV with the supported player built-in (you can't get 4K content through media players or computers at the moment) and a 25Mbit/s internet connection, and you have to upgrade your plan to the £8.99-a-month version, which also lets you have four streams. Quality is excellent, far outstripping that of Full HD, and with more titles coming online every month, the catalogue is steadily growing.



Amazon Prime Instant Video has also started to stream in Ultra HD in the UK. As with Netflix, you need a TV with a built-in app that supports the higher-resolution video. Most new TVs do, but it's worth checking before you buy. Amazon's home-grown content is largely shot and is available in Ultra HD, but a growing number of films are available, too. If you have a Prime account, you'll get a lot of this content included as part of your overall bundle; if you haven't, some of the films are available to buy or rent in Ultra HD.

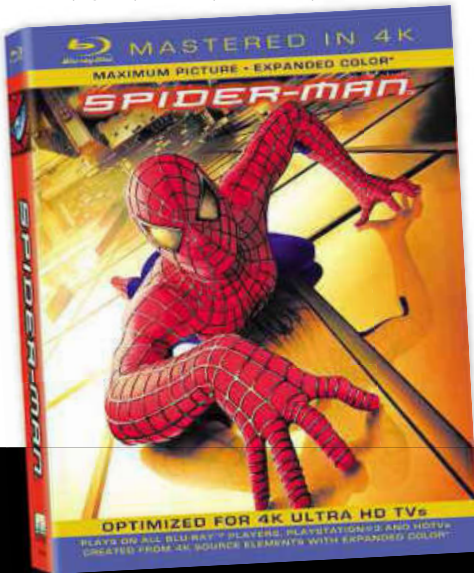
Amazon is the first service in the UK to support HDR, with content now available. However, you need a TV that supports the HDR standard.



couple of differences that are quite important. First, the discs have been created directly from the 4K or higher original masters, which should give a cleaner and clearer picture. Sony has also said that the compression used takes advantage of the X-Reality Pro processors in its TVs to make for better upscaling when you watch the discs on an Ultra HD TV. While you may get slightly better results than watching a regular disc, the results are still a way off a native Ultra HD image.

More importantly, the new discs use the x.v.YCC colour specification; if you have a TV and Blu-ray player, such as the PlayStation, that support this colour space, you'll get

↓ Sony's 'Mastered in 4K' discs improve on Blu-ray quality, but they're certainly not Ultra HD



Since the start of the year, the amount of Ultra HD content has grown massively in the UK, and it's only going to get better

better colour definition from these discs. Ultimately, 'Mastered in 4K' is really just a method of improving original the Blu-ray, and you won't get the full image quality and colour range as with true Ultra HD.

What do I need to watch Ultra HD content?

This one's an easy question to answer. First, you need a TV or projector with the correct Ultra HD resolution (3,840x2,160), so that you have something to watch the content on at the correct resolution. We've been using the Panasonic AX802 (see *Shopper 321*) to test Ultra HD in the UK. Make sure you buy a display with an HDMI 2.0 input (see below). If you use a home cinema amplifier or surround-sound system, it too needs to support HDMI 2.0 and Ultra HD.

Finally, you need a method of getting Ultra HD into your display of choice. Since the start of the year, the amount of Ultra HD content has grown massively in the UK, and it's only going to get better. See the box below to find out more about Ultra HD content.

HDMI 2.0

HDMI 2.0 is the updated cable standard, designed specifically for Ultra HD. It's important that you buy a TV, projector and, if you use one, AV amplifier that has an HDMI 2.0 port (there's usually be only one per device). You might assume all Ultra HD TVs have this as standard, but the early models didn't and used HDMI 1.4 instead.

This is a problem for two reasons. First, it limits Ultra HD to a maximum of 30fps (30Hz refresh rate), so you can't benefit from the standard's higher frame rates. Second, TVs without HDMI 2.0 don't support HDCP 2.2, the new copy-protection standard. This is a potentially serious problem, as newer Ultra HD kit, such as set-top boxes and Blu-ray players, won't work without it.

Finally, don't get ripped off buying expensive HDMI cables (see 'The HDMI cable con', *Shopper 331*), and don't listen to anyone that tries to sell you an Ultra HD cable. Provided the cables you buy are HDMI High Speed (most are), they'll work just as well with Ultra HD as they do with Full HD. **CS**

BT Sport ULTRA HD

BT is the first company to launch a 4K service in the UK, with BT Sport Ultra HD. It's streamed live over broadband but needs around 29Mbit/s to deliver the content, which means that it's only available to BT Infinity customers that have a fast enough line. As well as being the first service to deliver a live channel at the higher resolution, BT also uses the other advantages that Ultra HD offers, including a 50fps frame rate and greater colour depth. Footage looks absolutely stunning but has the downside of making Full HD channels look a little soft and blurry.

Content is rather limited at the moment and, if you're not a sports fan (and a football fan in particular), there's not a lot for you to watch. Still, it shows what the future of TV may look like.



↑ BT is the first UK company to launch a live Ultra HD service



YouTube has supported Ultra HD for a while, but it's not really a primary source for content, as it's largely user-generated. YouTube's videos may be useful for testing purposes, but if you want professional films and TV shows, it's not the place to watch.

COMING SOON: Blu-ray Ultra HD

Blu-ray Ultra HD is the standard that we've all been waiting for and we're now getting closer to launch, with the Blu-ray Disc Association recently signing off on the specification. Samsung has even demonstrated its first Ultra HD player, the UBD-K8500.

That's the good news. The bad news is that Samsung has said that the player won't launch until 'early 2016'. Even when it does, it's likely to be fairly expensive and the catalogue of Ultra HD discs will be poor. Traditionally, when a new format is launched, film studios first release a back-catalogue of terrible films as a way to make money on them from early adopters. For content that you'll actually want to watch, our guess is that you'll need to wait until at least Christmas 2016.



↑ The standard has been approved, but we won't see Ultra HD on Blu-ray until early 2016

Last & Will & Testament

I, Mark Elliot Zuckerberg, presently of 1 Hacker Way, Menlo Park, CA 94025, hereby revoke all former testamentary dispositions made by me and declare this to be my last Will.

DISPOSITION OF ESTATE

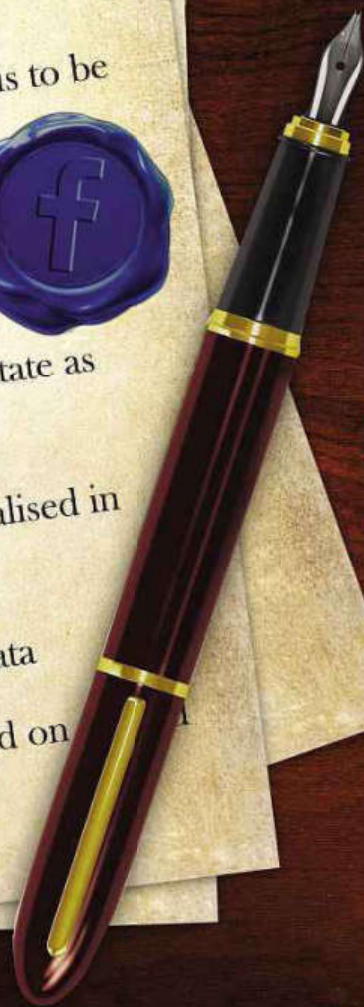
Distribution of Residue

I direct my Executor to divide the residue of my estate as follows:

“Mark Zuckerberg” Facebook profile: To be serialised in Time magazine over two years

“Mark Zuckerberg” Google+ profile: Erase all data

“ZuckluvsKatz” Instagram photos: To be printed on glass to adorn the Zuckerberg mausoleum



What happens to your digital life once you've shuffled off this mortal coil? We look at what companies do with your data and reveal how you can plan for your digital afterlife

DATA AFTER DEATH

It may be a rather morbid topic, like planning your own funeral, but we all need to consider what happens to our data after we pass away. In this feature we'll explain what happens to your online data and digital content when you die, and look at what tools are in place so that you can plan accordingly.

Your last will and testament is an essential legal declaration to decide what happens to your estate, and often the source of many a family dispute once things start getting divvied up. It should be a relatively straightforward process: your property goes to one party, your finances to another, your collection of obscure new-wave vinyl to another. It's a legal document that's been around for hundreds of years, and one that we all should have in place.

However, the proliferation of online

data in recent years has added new complexity to the mix. Most of us now live much of our lives online, with data both volunteered and collected through a multitude of platforms – whether it's the videos you watch, the searches you make on the web, the history of locations you've visited or the photos you've shared on social media. It's a whole new element of 'property' that needs to be considered in the event of your death.

ASSET MANAGEMENT

According to Sherron Alexander-Bedingfield, a will writer from the Sable Group in London, the first step is to decide what you consider to be valuable assets. These will include things with sentimental value, not just monetary worth. "Think about your activity online," she says. "Do you have investments in internet-only

accounts? Do you have funds within eBay, PayPal or online gambling sites?

"Of course, not all your digital assets will be monetary. Social-media accounts host personal messages, photographs, video clips and more – to a family member, this sentimental treasure trove may be worth more than any financial gift.

"Domain names are another, often overlooked, digital asset; while normally not worth much on the surface, there is always the chance that domain names could suddenly become valuable."

Many online services now have plans in place to take care of your data after you pass away or find yourself unable to manage your assets, or at least intend to roll out such features in the future, so you can prepare in advance. Otherwise, you'll be relying on those left behind to manage your



Since the introduction of Windows 8, a Microsoft Account has been used as a sign-in method, and this has continued with the latest Windows 10 operating system. A Microsoft Account can also be used for other Microsoft-owned services, such as Skype.

Unless you leave your Microsoft Account details with a friend or relative, there will be no way to access your account unless they go through Microsoft's account recovery process, but this will require access to the email address used for the Microsoft Account. On page 118 we outline leaving behind important username and passwords in a 'personal asset log'.

Microsoft's Outlook email service includes a procedure called 'Next of kin' for family members to get access to the deceased's Outlook email data. To

do this, you simply need to email msrecord@microsoft.com and provide:

- Your first and last name
- Your phone number
- Your email address
- The full name of the deceased or incapacitated family member
- To the best of your knowledge, the Outlook.com accounts belonging to the family member

Content will be transferred to a DVD, which is then sent to the requestor. This will include emails and their attachments, address books and contact lists. You will not be given username and passwords to access an Outlook account, however, which Microsoft says is to safeguard the privacy and security of its users even after their death.

Microsoft | Account

Recover your account

We can help you reset your password and security info. First, enter your Microsoft account and follow the instructions below.

Or use a phone number



Enter the characters you see

Next

You'll need access to the Microsoft account's registered email address to retrieve the password

facebook

Facebook is undoubtedly a great way to keep in touch with family and friends, and to share photos and videos. The service already positions itself as a way to chronicle our lives' memorable experiences. It provides timely updates and reminders of what exciting things we might have shared on anniversary dates, tinged with a hint of nostalgia so we can look back through time, and it also provides 'Look Back' videos.

Many of us live a second life on Facebook. It's become so popular that the platform broke a new record on 24th August 2015, with one billion users logging into the service – that's one in seven of the world's population.

With so many people around the world using the social media platform, Facebook has been forced to have conversations about death and loss with its users. Over time the company has introduced new features and settings based on those discussions in order to make the bereavement process much simpler.

The element of nostalgia and remembrance makes Facebook profile pages a potentially fitting memorial for those who've passed away. You can, for instance, decide that your Facebook page be 'Memorialised' in the event of your death. Facebook describes these memorialised pages as "a place for friends and family to

Special Request for Deceased Person's Account

Please use this form to request the removal of a deceased person's account or for memorialization special requests. We extend our condolences and appreciate your patience and understanding throughout this process. Unrelated inquiries received through this channel may not receive a response. To protect the privacy of people on Facebook, we cannot provide anyone with login information for accounts.

Your full name

Full name on the deceased person's account

Account email address of the deceased person
The email that may have been used to create the account

Web address (URL) of the timeline

Please note that we require verification that you are an immediate family member or request.

Relationship to this person

☐ Immediate family (spouse, parent, sibling, child)
☐ Extended family (grandparent, aunt, uncle, cousin)
☐ Non-family (friend, colleague, classmate)

How can we help you?

☐ Please memorialize this account
☐ Please remove this account
☐ I have a special request
☐ I have a question

When did the person pass away?
Add year

Please provide verification that you're an immediate family member
You'll need to upload documentation like a death certificate, the deceased person's birth certificate or proof of authority

Additional information
If you have a special request or question, please use this space to provide more information:

You can request that a Facebook account be memorialised after you die so friends and family can still share memories on your timeline

gather and share memories after a person has passed away".

It should be noted that posting on a memorialised page is only available if your privacy settings allow it or, as Facebook explains, "in a manner consistent with the deceased person's expectations of privacy". Importantly, to avoid potentially upsetting or

offending anyone, memorialised profiles won't appear in public spaces such as 'People you may know', adverts or birthday reminders. You can report a profile for memorialising from the Facebook help pages at tinyurl.com/334facebook.

A new option that Facebook has recently introduced is that of a 'Legacy Contact' as an additional means to manage a memorialised account after a person has passed away. Previously, basic memorialised accounts were only viewable and couldn't be managed or edited in any way. After a page is memorialised, a 'Remembering' denotation is added above the person's name. Your legacy contact is then also able to pin a post to the top of the timeline.

To turn on Legacy Contact, you just need to head to the Settings section of the Facebook website or app. Then go to Security and finally Legacy Contact. Your legacy contact nominee will need to be a Facebook friend. Search for their name in the field. You then have the option to send a message to the user explaining that you have nominated them. It's probably a good idea to give them advance notice so it won't be a complete shock to them.

It's at this point you can decide if you want to give your legacy contact permission to download an archive of

Google

Google collects bountiful amounts of data on its users, thanks in part to the sheer number of products and services it operates. Whether you use an Android smartphone or tablet, watch videos on YouTube, use Google Maps for navigation or just use Google for web searches, the chances are you're leaving digital records as you go along.

Fortunately, most of these can be managed from one location with the company's unified account system. Google has a tool called 'Inactive Account Manager' (www.google.com/settings/account/inactive) which, as the

name implies, allows you to decide what happens in the event of a set period of account inactivity. It also allows you to choose who can have control of your account after you're died. This inactivity period can be anything from three months up to 18 months. We probably wouldn't advise setting this Timeout Period to the shortest time, however, as you could easily go three months without accessing your account.

Once you've set the Timeout Period, you can decide what happens with all your data. Inactive Account Manager can be set to delete your Google

Google lets you appoint an inactive account manager to deal with your data

account completely, removing all associated data including content such as uploaded YouTube videos, posts on Blogger and your Gmail messages.

Alternatively, you can entrust your data to a nominated family member or friend, and decide what data is available to them. This means you can give them access to your Google Drive and YouTube account but not Gmail, for example. In the event of your account

Add trusted contact

To: Dawn Easton <dawneaston0402@hotmail.com>

Select data to be shared with this trusted contact

Once your account has timed out, your trusted contact can download your data for 3 months:

☐ Select all

- | | |
|--|---|
| <input type="checkbox"/> +1s | <input type="checkbox"/> Google+ Pages |
| <input type="checkbox"/> Bookmarks | <input type="checkbox"/> Google+ Stream |
| <input type="checkbox"/> Calendar | <input type="checkbox"/> Hangouts |
| <input type="checkbox"/> Contacts | <input type="checkbox"/> Mail |
| <input type="checkbox"/> Drive | <input type="checkbox"/> Profile |
| <input type="checkbox"/> Google Photos | <input type="checkbox"/> Voice |
| <input type="checkbox"/> Google Play Books | <input type="checkbox"/> YouTube |
| <input type="checkbox"/> Google+ Circles | |

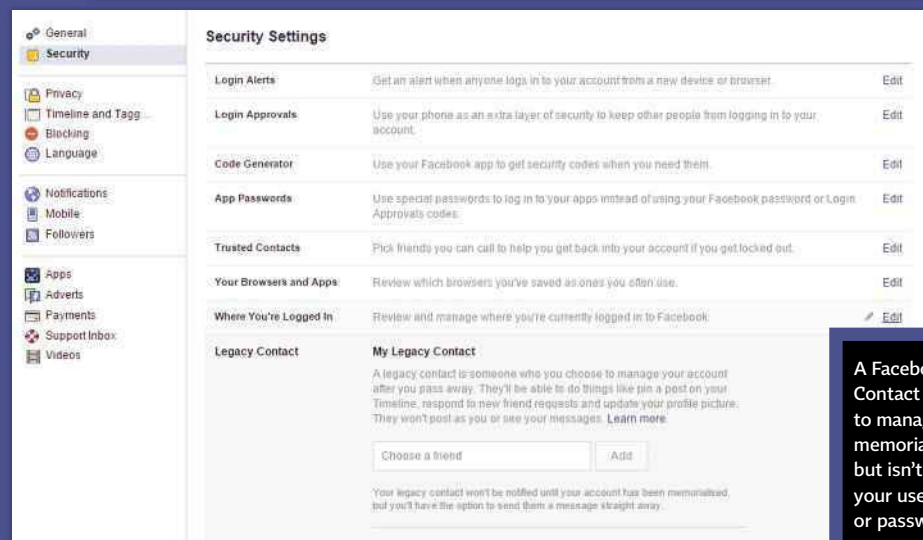
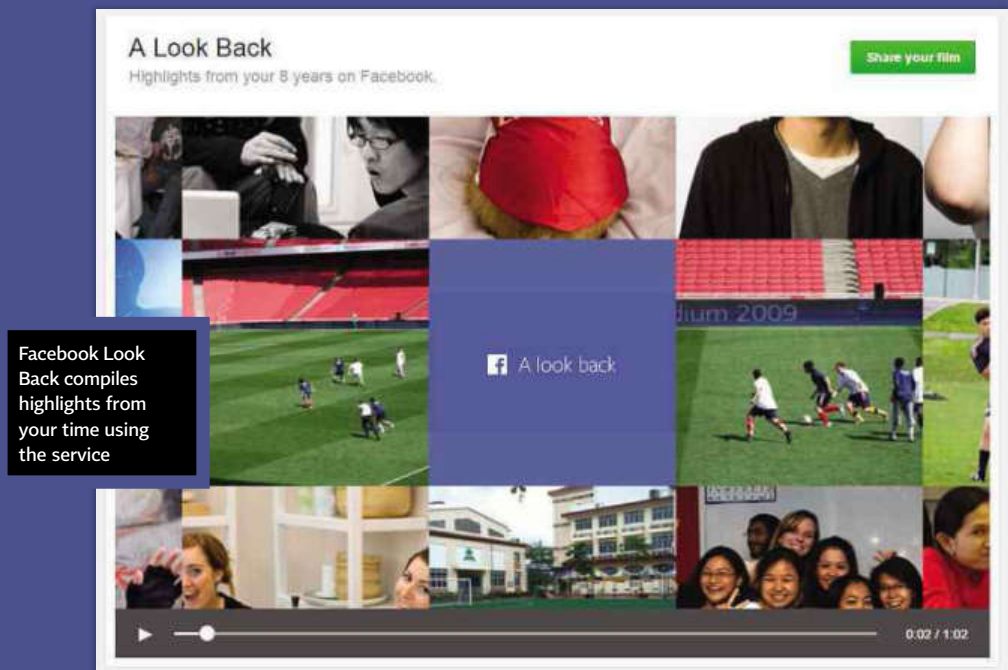
your Facebook posts, photos and profile information. Alternatively, if you don't want your account to be memorialised even at the request of a loved one after you pass, you can opt to have your account deleted from the same menu.

Look Back

Facebook's 'Look Back' videos were created by Facebook's engineers to celebrate the company's 10th anniversary in 2014. These personal movies were created with Facebook users' posts and photos that have been shared over the years.

Facebook will create Look Back movies on request for accounts that have been memorialised, making a touching tribute to those who have passed away. The only prerequisites are that the user's account be in a memorialised state, that the requestor be a Facebook friend with the account holder in question and that there's enough content to generate a movie.

If a movie is generated for your loved one, you'll be sent a unique link to watch it, but it can't be shared in order to maintain the privacy of the deceased. Anyone else who would like to view the Look Back video can submit their own request. Requests for Look Back videos can be submitted at tinyurl.com/334lookback.



timing out, the nominated user has three months to download your data.

Setting a Timeout Period could potentially lead to erroneous deletion if you're not careful. Fortunately, Google will alert you before it is set to happen. If you've set a Timeout Period of three months' inactivity, you'll get a one-month alert before it happens, while if you select 18 months of inactivity you'll get a warning three months in advance.

Contact's phone number

To protect your information from unauthorized access, trusted contacts will need a verification code to access your data. Trusted contacts will receive a verification code after your account becomes inactive.

Select a country ▼

Phone number

Repeat phone number

YAHOO!

Unlike Microsoft Outlook, there's no way to get access to the content of a deceased person's Yahoo! account in any shape or form. Yahoo! states that this is "to protect the privacy of your loved one... it is our policy to honour the initial agreement they made with us, even in the event of their passing". This is something you agree to when signing up for an account.

All that can happen in the event of someone's death is that the account be closed and billing and premium services be suspended. Account closure can be processed by emailing legalpoc-support@yahoo-inc.com with the Yahoo! ID of the deceased, a copy of the document appointing the



requesting party as personal executor and a copy of the Yahoo! account holder's death certificate.





Instagram

Instagram photos are a great way to remember someone who has passed away. Instagram – like Facebook, its parent company – can memorialise an account in the event of a person's death. Memorialised accounts can't be changed in any way, including any changes to likes, followers, tags, posts or comments, but they will also not show up in public spaces.

You also have the option to request that an account be removed. Unlike Facebook, however, there's currently no option to nominate a legacy contact, so you can't decide in advance what you would like to happen to your account. Only verified family members can request the removal of an account, and they will need to submit a death certificate for the deceased or a proof of authority to show they are the lawful representative.

twitter



Twitter users tend to share quite a lot about themselves on the platform, albeit 140 characters at a time. Many of us now attach and share plenty of images and video to our tweets, so there's a wealth of data and a substantial online legacy you need to manage.

Unfortunately, besides leaving your account in all its glory, there's no way to create a Facebook-style memorial page. There's also no way to plan ahead for your death, so if

you decide you don't want to have your Twitter page to be available after you've gone, you'll need to trust an authorised person to request Twitter deactivate your page.

They'll need a copy of a death certificate and proof of their own ID. Twitter states it will not provide account access to anyone, regardless of their relationship to the deceased. A request can be submitted via Twitter's privacy form at [support.twitter.com/forms/privacy](https://twitter.com/forms/privacy).

DIGITAL CONTENT

If you have a large collection of music, paintings or books, you can bequeath them to your heirs when you die. In the digital age, however, things become considerably murkier when it comes to digital ownership and the right to pass on content.

If you read through the End User Licence Agreement (EULA) for most services that sell digital content, such as Apple's iTunes or Amazon's Kindle eBook library, you'll find you're not actually buying content. Rather, you're merely purchasing a licence for it for your own personal use; a licence that is typically non-transferrable.

As Amazon puts it, "Kindle Content is licensed, not sold, to you by the Content Provider... Unless specifically indicated otherwise, you may not sell, rent, lease, distribute, broadcast, sublicense, or otherwise assign any rights to the Kindle Content or any portion of it to any third party, and you may not remove or modify any proprietary notices or labels on the Kindle Content."

Apple iTunes' EULA clearly has a 'No right of survivorship' clause written in, stipulating that you agree your account is non-transferable and that any rights to your Apple ID or content terminate upon your death.

According to Paul Gotch, an associate at JMW Solicitors and a wills specialist, users may be able to take advantage of Apple's 'Family Sharing' facility. "The terms and conditions do specify that the 'family sharing' facility is available, whereby music, movies, TV shows and books can be downloaded from the iTunes Service on up to 10 devices per account. This would appear to provide a method of ensuring that

family members have access to the content of a family member who has passed away, albeit for a fee," he said.

When it comes to Apple devices, such as iPhones or iPads, Apple will deactivate any security locks on a device and restore it to its factory settings provided the deceased's death certificate and will stating the devices have been bequeathed are provided.

Even Google's Inactive Account Manager, which makes certain aspects of digital legacy a simple affair, omits content purchased from the Google Play store, such as music, video or apps. The terms of service state: "You may not sell, rent, lease, redistribute, broadcast, transmit, communicate, modify, sublicense or transfer or assign any Content or your rights to Content to any third party without authorisation, including with regard to any downloads of Content that you may obtain through Google Play."

PERSONAL ASSETS LOGS

According to Mike Smoult of Gorvins Solicitors, you should create a 'personal assets log' for your digital content that "has a list of all your digital accounts so that your executor can arrange to close your accounts, and your family have permission to access digital media they may want to keep, such as photos and videos".

However, leaving usernames and passwords in your personal assets log could be an offence under the Computer Misuse Act 1990. Instead, leave the necessary information for your executors so they "will be able to contact the relevant website or service provider to gain access". This, however, won't help you in the case of accessing



Password managers can store your usernames and passwords in a digital vault that can be shared after your death

digital content purchased through iTunes, Amazon or Google Play.

Some solicitors recommend you keep a hard copy of your account details, provided they don't breach a service provider's terms of service. Paul Gotch advises that it is "important that this information is not included in a will, as ultimately, once submitted to probate, the will becomes a public document and is thereafter accessible to anyone who applies for a copy".

Another option is to use a password management service that has an emergency procedure in place for when you are unable to provide access yourself. Services such as Dashlane (www.dashlane.com) will store all your passwords in an encrypted vault. In the case of a person's death, an Emergency feature allows a nominated party to request access to your account. You can decide how long you have to respond to the request, after which the person will automatically be granted access. You can also specify which passwords are shared. In the case of Dashlane, emergency contacts will also need to sign up to a Dashlane account.

FORWARD PLANNING

It might not be the most pleasant thing to think about, but your digital legacy is just as important a consideration as your traditional estate when it comes to your will. Ensuring your digital assets and data are all in order will also make the bereavement process easier for those left behind, so make sure you're prepared. **ES**

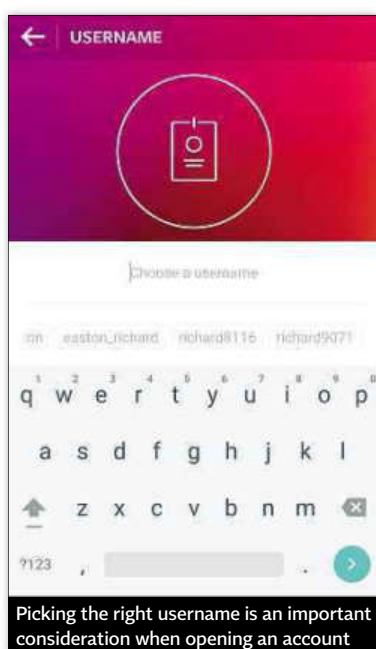
Complete guide to Instagram



Instagram is a great way to shoot photos and videos, and share them with the world. Richard Easton shows you how to use the service

Getting started

The first thing to do is to download the Instagram app for your smartphone or tablet. It's available in the Apple App Store for iPhone and iPad users, and in Google Play for Android devices. There's also a beta version available for Windows Phone.



As with Twitter and other social media sites, you'll want to choose a unique username during registration. This is important as it's the name people will use to find you on Instagram and to follow you or @mention you (see glossary on p123). It's therefore probably best not to choose anything too embarrassing but to try instead to reflect your personality or interests.

Your username will show up whenever you 'like' or comment on someone else's pictures, so if you use it to indicate what your interests are, it may help you build up a larger Instagram following. Think 'FitRich' if you're into fitness and your name's Richard, for example. Instagram is a Facebook company, so you can also use your Facebook account to speed up the registration process, or just use an email address.

Choose a profile photo

Like your username, your Instagram profile photo can give a good indication of what your interests are. If you're into fishing and intend to post lots of photos related to your favourite pastime, for example, consider a profile photo that indicates this. It will help you attract followers who share your interest, as they'll instantly get an idea of the type of content you'll post. Your profile picture can be a photo from your smartphone's gallery, a new photo taken with your smartphone camera or a picture imported from Instagram or Facebook.



Choose people to follow

Now you can start looking for people to follow. Instagram can, with your permission, look through your Facebook friends to see if any of them are also on Instagram. It can also look through your smartphone's contacts list. This is a quick way to start adding people you know. Instagram then recommends other people to follow, although they're typically celebrities, such as Taylor Swift, so might not be relevant to your interests.

Choose who can follow you

If you don't want to allow just anyone to follow your Instagram exploits, you can set your account as Private in the Options menu, accessed from your Profile page. With this setting in effect, you'll have to approve all new followers manually. It won't block people who started following you before you switched on Private Account mode, though, so if privacy is important it's best to switch this on straight away.

Navigating Instagram

The Instagram app looks the same whether you use Android or iOS, with five main sections. The main screen has a row of five icons at the bottom.

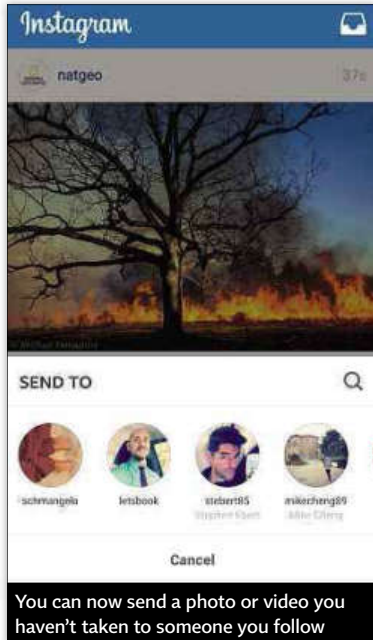
Home

You'll start on the Home (or timeline) screen. This is where content from people you follow is collated. If you're not following anyone, nothing will appear here, so start by following people you know or people you're interested in. You can find them using the Discover function.

The Home screen is where most of your Instagram interactions will take



place. As you scroll down the screen, content from the people you follow appears in a list format. You can 'like' an image by tapping the heart icon or by double-tapping the photo or video itself. The number of likes a piece of content has received appears beneath it. You can also leave a comment, which will appear publicly.



A recent feature is the ability to send a link to a photo or video that someone else has taken. So if you come across a photo you think one of your friends will like, you can direct their attention to it through an Instagram DM (see glossary on p123) with an embedded link to the post. Just touch on the arrow icon next to the Comments button. Before this feature arrived, Instagram users would @mention friends in the comments to notify them about the image. Instagram added the Send To feature to help tidy up the resulting clutter, which was getting in the way of its intended purpose of leaving comments.

Instagram Direct

From the Home screen, you can access Instagram Direct by tapping the tray icon at the top-right of your screen. From here you can see any Instagram Direct conversations you have running. Content you send to one of your friends using the Send To function will also appear here, grouped by person. Hitting the '+' icon lets you send a photo, video or message to someone you follow. You can't tag people in Instagram Direct messages and they won't appear on hashtag or location pages, so the conversation is private.

If you want your photo or video to reach a wider community, you should consider researching popular hashtags

Discover

The Discover tab is accessed by touching the magnifying glass icon. Here you'll see a curated feed of content. Instagram pulls together things it thinks will interest you, based on the people you follow. So if you follow a lot of food bloggers, you'll probably see a lot of food-related photos and video appearing here.

At the top of the screen is a Discover People option that recommends people you might like to follow, again based on those you already follow. Above this is a search option. Touch this and use the options that appear below the search field to perform searches based on usernames, hashtags or places. This is particularly useful if you want to find photos from a specific restaurant or tourist hot spot, for example.

Searching for a hashtag will show you how many posts have used that particular descriptor. If you want your photo or video to reach a wider community, you should consider researching popular hashtags. It will improve your chances of picking up lots of likes and followers.



Capturing your first photo or video

It's time to start posting photos and videos of your own. As you might expect, you can access your library by touching the camera icon. This presents you with three options: Gallery (or Library in iOS), Photo and Video, all of which appear at the bottom of the screen.



Choosing the Gallery option lets you scroll through images and video saved on your smartphone, which you can then share. There are two icons at the bottom of the image preview.

The first of these is a new Expand icon. Previously, Instagram insisted that users post images in its famous 1:1 square cropped format. The Expand icon allows you to share your image in its original aspect ratio, whether that's portrait or landscape, so you no longer risk cropping people out of images.

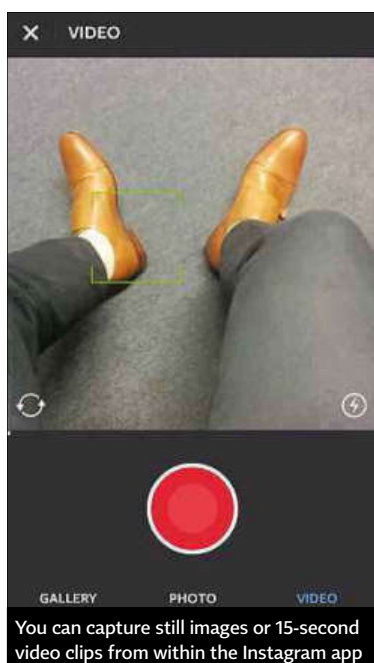
The other icon is for Layout. This is actually a link to a separate app, which you'll be asked to install if you touch it. The app enables you to make collages of numerous images that you can then share in the Instagram app.



Select the Photo option to take a photo. If you use the built-in camera, you can only capture images in Instagram's square format. If you want to share photos in any other aspect ratio, you'll need to use your phone's own camera app and share the photo through the Gallery option instead. There are icons for toggling between the rear and front-facing cameras, as well as for turning the flash on or off.

The video mode doesn't look very different from photo mode, but the shutter button turns from blue to red. Simply hold the button to capture video – you can capture a maximum of 15 seconds. Releasing the button and then touching it again creates cuts in the video, and you can delete the last recorded segment if it's not perfect.

Once you've finished selecting or capturing an image or video, touch



the blue right arrow in the top-right of the screen to move on. The next screen provides access to Instagram's famous filters. These apply various artistic effects to the photo or video to give it a stylish flourish. They vary from adjusting the saturation to adding vignetting. Double-tapping a filter brings up a slider so you can adjust the level of the effect.

You can also tweak the contrast using the Sun icon or hit the Spanner icon to make additional adjustments. Here you can make more subtle changes to the image, as well as adjust the image's rotation using the Adjust option and change the zoom using pinch gestures. Once you've finished tweaking, hit the forward arrow in the corner to move on to the next stage.

On the next screen, you can write a description of your image. This appears directly below the picture. You can use hashtags here to help your shot reach a wider audience of people who use or search for that particular hashtag.

Use the Tag People and Add Location options to add additional information. Tagging people makes the shot appear in their profile page under 'Photos of you'. A few location recommendations based on your smartphone's GPS position will appear under this, and you can scroll horizontally to see more locations or simply search for the place yourself. If you add location detail to your photos, these will appear on the Photo Map on your Profile page to show what a worldly traveller you are.

Under the Share section, you can elect to share your Instagram post automatically through other social platforms you've integrated with your account, including Facebook and Twitter. Once you've finished, hit the tick in the corner and you're done.

Activity

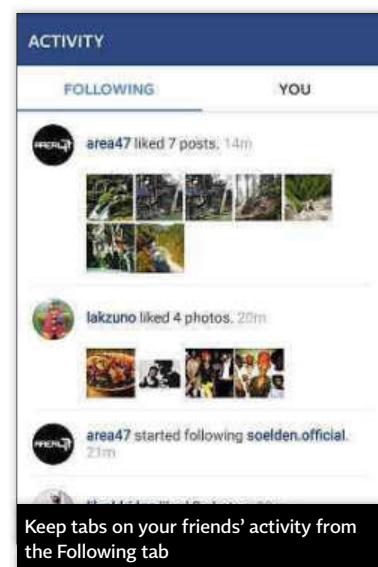
Access the Activity tab by tapping the speech bubble icon. Activity is divided into two tabs for Following and You. The You tab is where all your Instagram notifications are listed, including any @ mentions of your username, new comments on your posts and people who have liked your content.



The Following tab shows you what the people you follow have liked on Instagram. It's a great way to find new content and users in which you might have a mutual interest.

Profile

Last but not least is your Profile page. At the top is a running tally of the number of posts you've made, as well as the number of people you follow



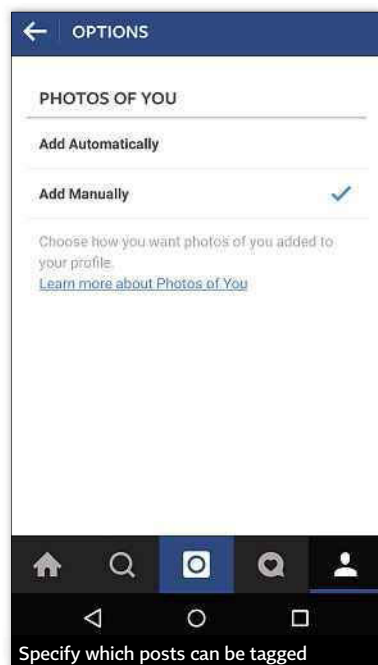


and who follow you. Touching any of these will take you to a relevant list.

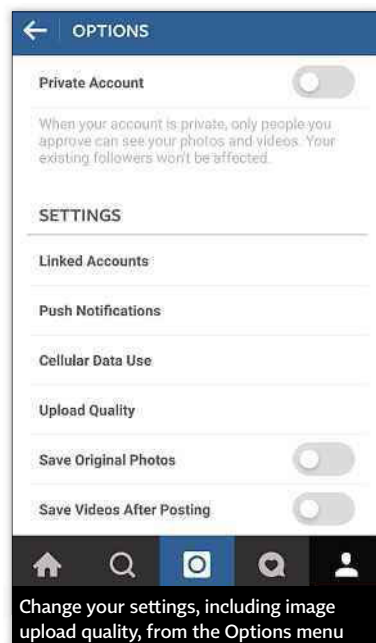
You can use the Edit Your Profile button to make changes to the text description that appears on your profile. Use this to describe your interests so users know who you are and what to expect from your account.

Four icons appear below this. The grid and list icons display all your posts formatted accordingly – or, if you're viewing someone else's profile, all their posts. Viewing posts as a list makes it easier to scroll through every post complete with the relevant comments.


The pin icon brings up a photo map showing the number of photos you've taken in different locations. You can use a pinch gesture to zoom in and out of the world map. Zooming in closer to a country provides finer detail such as cities from which you've posted images.



The remaining icon on the Profile page is for 'Photos of you' (or of the person whose Profile page you're viewing). Here all relevant posts that have been tagged with a specific Instagram user are posted in a grid format. If you hit the Options menu from here you can decide whether photos tagged using your username are added automatically or only once you've approved each one manually.



Finally, from the Profile page you can access Options. Useful features here include the ability to access the posts you've liked, which makes the 'like' feature useful for bookmarking posts you want to see again later. You can also tell Instagram to use less mobile data, although this might slow down the overall experience, and change image upload quality.

There are also toggle controls to 'Save Original Photos' and 'Save Videos After Posting'. These affect what happens to shots you take with the Instagram native camera. With the first option turned on, a full, uncropped version of the photo is saved to your phone. Similarly, the latter option saves a local version of any video you record. If you find that you often run out of space on your device, it might be worth turning these options off to avoid using too much storage. 



Instagram glossary

@mention

This is when you mention someone directly over Instagram using their username. The message is public and will appear in the comments below an image or video, but the user in question will receive a notification. Many people use @mentions to draw someone's attention to a particular image or video or to credit someone with a photo.

Tagging

When anyone posts an image or video to Instagram, they have the option to Tag an Instagram user. This means the photo or video will appear in the 'Photos of you' section of that user's profile.

DM

Direct messages sent through Instagram's private messaging channel, Instagram Direct, can be seen only by the recipients, unlike public mentions or posts.

Like

Clicking the heart icon beneath a photo or video will 'like' the content. It's a way of showing your appreciation for a particular image or video, and is also a way to bookmark content that you might want to find again.

Hashtag

A means of tagging photos and video according to a particular theme or using a popular description. Hashtags are often used by Instagram communities that share an interest such as cooking or fitness. They appear in photo descriptions or comments, and tapping on them reveals other content that uses the same hashtag. Examples could be #archery or #instafood.

Location

Like a hashtag, you can add a location to your images. Many public spaces and businesses are already set as locations, so you can choose the specific restaurant you're taking photos in. People can then view content grouped by location, which is a great way to research a place you're going to visit. The location even shows up on a map.

Follow

The equivalent of being friends with someone on Facebook, although they don't have to follow you back. Content from people you follow appears in your Instagram timeline.

The pin icon brings up a photo map showing the number of photos you've taken in different locations

facebook



Want to keep your Facebook posts private from certain people, or sick of friends posting rubbish? Here's how to take control of your Facebook feed

Facebook is a great way to keep in contact with family and friends, but it can also mean you become inundated with mundane or annoying content or, at worst, a place where people are harassed or bullied. Fortunately, you don't have to put up with people you don't want to have anything to do with, as you can simply block them and

remove their ability to contact you or see anything that you post. In this article, we'll show you how to block people and, in case you change your mind, how to unblock them. We'll also show you how to unfollow someone: this hides their posts from you, but you remain friends. This latter option is great for people that are plain annoying.

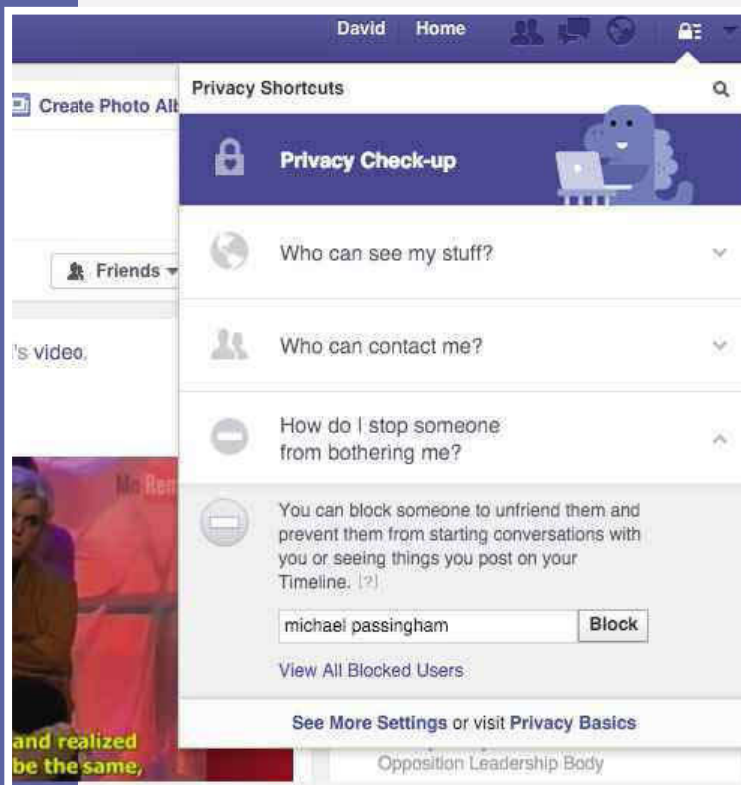
How to block someone on Facebook

We'll start with the most extreme case: blocking someone. This option completely blocks another Facebook user from being able to contact you. In the most extreme of cases, you might want to completely block someone from being able to contact you or even

STEP 1

Use the privacy menu

Go to your Facebook page and click the privacy icon (it looks like a padlock and is at the top-right of the screen) to bring up the Privacy shortcuts button. Click the 'How do I stop someone from bothering me?' option and then type the name or email address of the person that you want to block into the box and click the Block button.

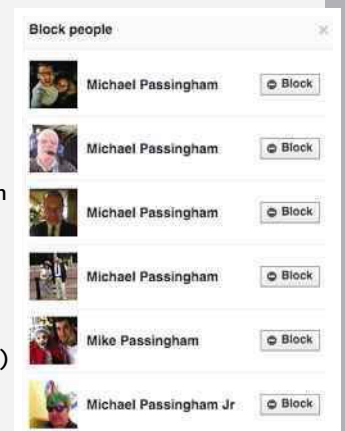


add you as a friend (if you're friends with the person already, this option will unfriend them). Fortunately, Facebook makes this very easy to do through its Privacy Shortcuts menu, as we'll explain here.

STEP 2

Select the person from a list

Search for the name of the person you want to block. You'll see a list that matches your search, so you can select the right person. Anyone that you're already friends with (or are friends with friends) will most likely appear at the top of the page. You then just have to click the Block button next to the person (or people) you want to block.



STEP 3

Confirm the block

You'll next see a dialog box warning you what blocking will do. That person won't be able to see you or add (or re-add) you as a friend. Alternatively, Facebook proposes you contact the person to let them know they've been bothering you. You can also choose to remove their posts from your News Feed (see opposite). If you're happy that you want to block someone click the Block button to continue.

Once someone is blocked, if they try to access your profile they'll get a message telling them they've been blocked.



How to unblock someone

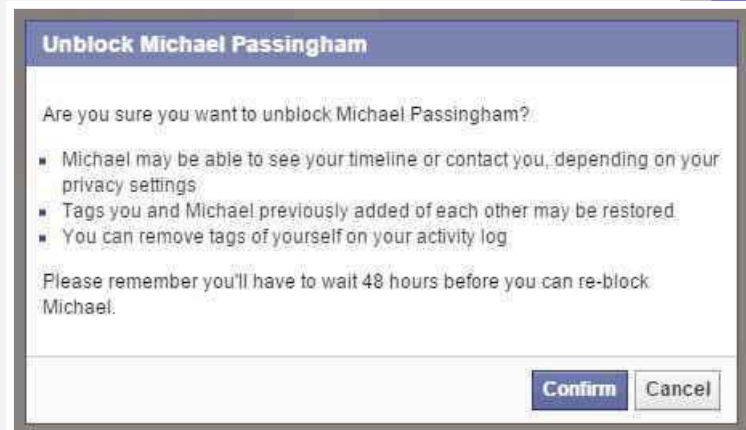
If you blocked someone and have had a change of heart and want to become friends again, you can unblock the person. We'll explain how to do that here, but once you're done, you'll need to add each other as friends again.

STEP 1

View blocked people

Open up Facebook and click the privacy icon (the padlock at the top of the screen) and click 'How do I stop someone from bothering me?', then the View All Blocked Users link. You'll see a dialog box that shows you everyone you've blocked. Click the Unblock button next to the person you want to bring in from the cold.

If you go back to the 'How do I stop someone from bothering me?' option (Step 2 of 'How to block someone on Facebook', opposite) you can also access a list of people you've blocked. From here you can also choose to unblock a user.



STEP 2

Confirm the unblock

Confirm you want to unblock the user on the next screen. This won't automatically make you friends again, so one of you will need to mend bridges by sending a friend request. Note that you can't reblock someone for 48 hours if you change your mind again.

How to unfollow a user or hide their content

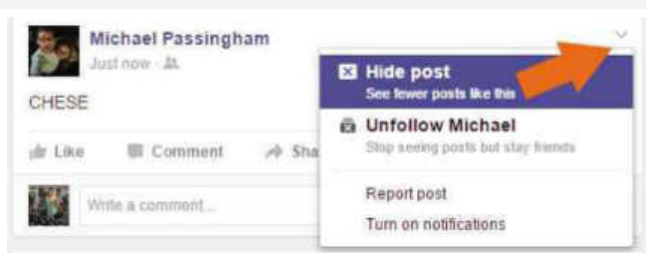
Less extreme than blocking someone outright, you can choose to 'unfollow' a Facebook user instead or hide their content from your News Feed. This removes their posts from your News Feed and

helps to cut down on the clutter. It's a great way of dealing with people who are simply annoying or post too much, and means that you'll remain friends.

STEP 1

Unfollow a user

First find a post from the Facebook user that is cluttering your News Feed. Click the downward-pointing arrow on the top right of their post. This will bring up an options menu. Click the 'Unfollow [user]' option and all posts by that person will be removed from your News Feed and new ones will not appear. You'll still remain friends, the person you unfollowed won't know that you've hidden them and you can still view the hidden person's content by going to their profile page.



STEP 2


Hide a post/see less from a person

If a person has only posted one thing that's annoying, you may just want to hide a single post. Click the drop-down arrow next to the person's post and select Hide post. This will remove that single post from your screen. From the confirmation screen, you can escalate things by selecting 'See less from [User]'. This reduces the frequency that a user's posts will appear in your News Feed, without unfollowing them.

The above steps work not only for Facebook users, but also Facebook pages that you've 'liked'. If you find a page is spamming your News Feed with content, you can reduce the number of posts or unfollow it in a similar way.

How to follow someone again

If you've hidden someone from your feed but want to see their posts again, simply go to the person's profile page and click the Follow

button at the top of the page (to the right of their name). You'll now start to see anything new they post in your News Feed. 

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- STEP 4** Enter your Google password to confirm



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- STEP 2** Tap the 'Subscribe' button
- STEP 3** Choose whether to create an optional Zinio account
- STEP 4** Enter your Apple ID password to confirm



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How to...

Get more battery life from your Windows 10 laptop

Can Windows 10 help boost your laptop's battery life? We test the new Battery saver mode to find out

WINDOWS 10 PROVIDES many benefits over previous editions of the operating system, but improved battery life probably isn't one of the main advantages you'd think about. However, Microsoft has done a lot of work with its battery-saving technology, making your laptop more efficient and last longer. The main setting, Battery Saver, is enabled by default, so you don't have to do anything, but in this article we'll show you how to change Windows' battery options and reveal how upgrading to Windows 10 affected battery life on our test laptops.

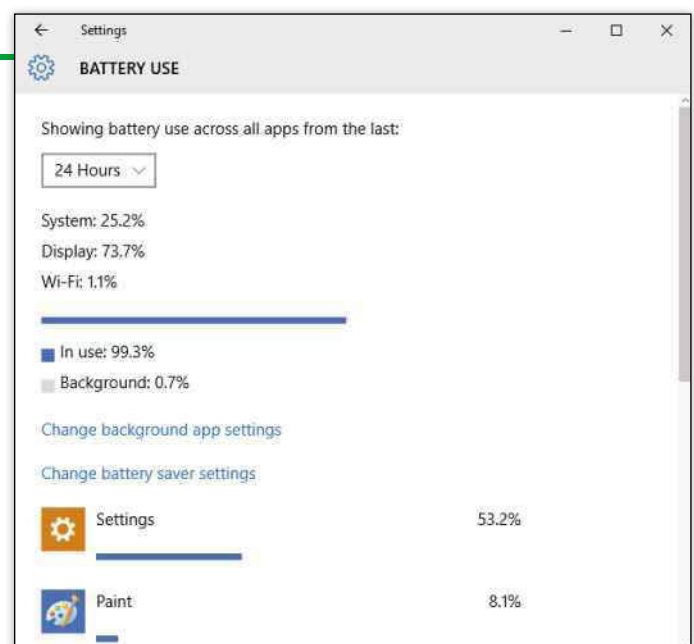
BATTERY SAVER

The first place to start is with Battery Saver, which is a new option in System settings. It's designed to lower screen brightness, reduce background activity and stop push notifications when your battery hits a certain point (20% by default), reducing the load on the battery. While the defaults are good enough for most people, you can control the settings in more detail.

To access it, click the Start menu, type Battery Saver and choose the option that appears. You'll see the Battery Saver dialog box, which gives you an overview of your laptop's battery life, including the remaining percentage and the estimated time remaining.

BATTERY USE

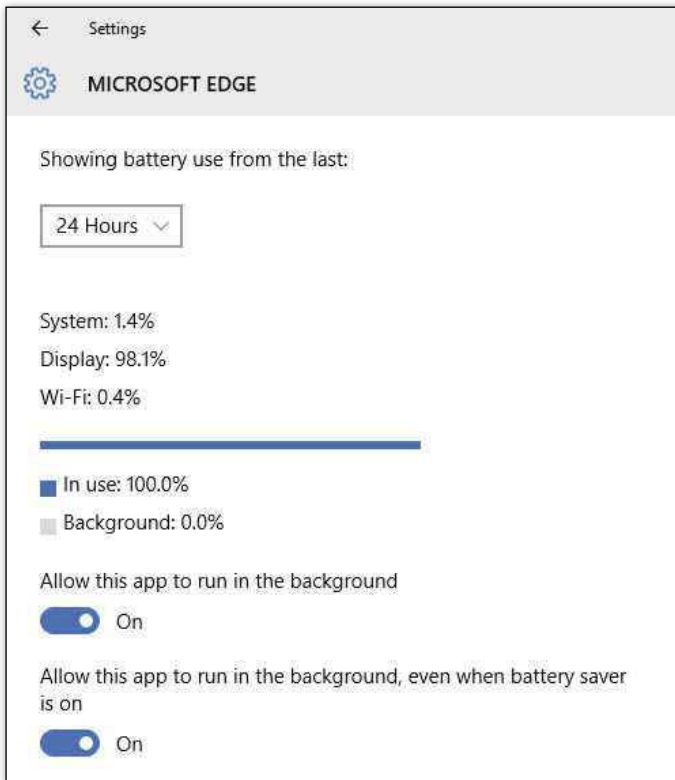
You can click the Battery Use link to take you to a screen that shows you what's been eating your battery life up. From this screen you can see how much time was devoted to the main laptop components: System (CPU, hard disk, apps and so on), Display and Wi-Fi. This is useful information, as you may want to turn down your display brightness by default if it's using a lot of power, for example. Next, you



◆ The Battery Use app tells you what's using the power on your laptop

can see a list of applications and how much time they've been using. This is represented as percentage of total application use, not percentage of battery use.

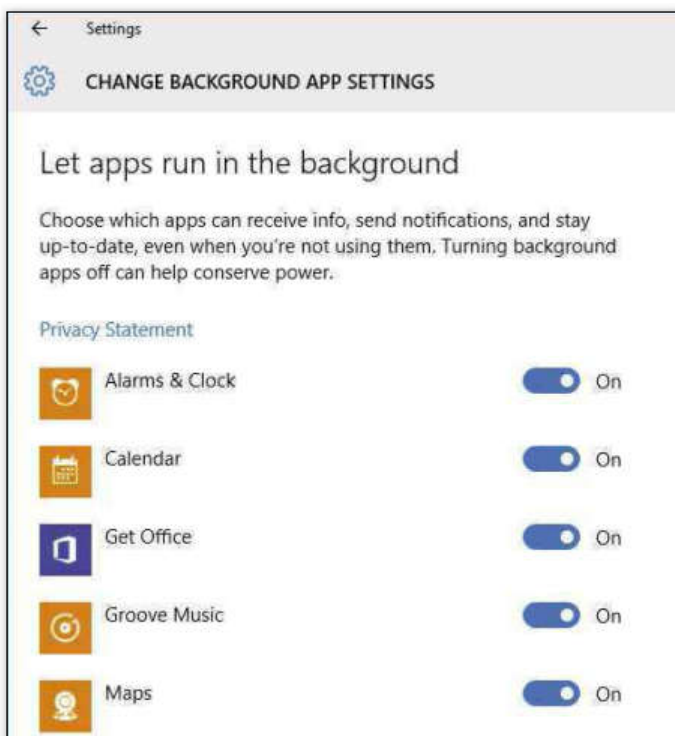
Click any app in this list and you can click Details to drill down and get more information, including how much System, Display and Wi-Fi time that app has been using. There's also a block to tell you how much



↑ Find out how much power an individual app has been using

time the app has been consuming while in use (in the foreground) and how much time it has been using in the background working away. Depending on the app, you can use the sliders to control whether it can run in the background and if it's always allowed to run in the background, even when Battery Saver is enabled. Only full-screen Windows 10 apps (not standard Desktop applications) have these options, and even then, the options are limited to only some apps.

To see more easily which apps can run in the background, go back to the Battery Use dialog box and click the Change background apps

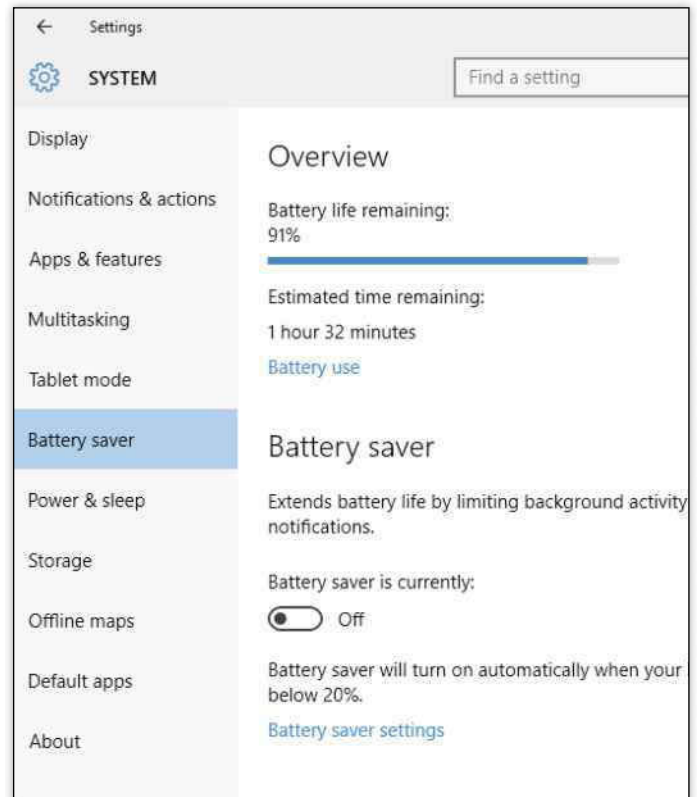


↑ From this screen you can change which apps can run in the background.

settings. You can now view all the apps that can run in the background and use the sliders next to their names to allow or disallow this feature.

BATTERY SAVER SETTINGS

Back on the main Battery saver screen, you can toggle the mode on and off, using the slider if you want to enable it manually, but unless you know you're going to spend a long time away from a power socket there's little reason to do this. To make more advanced tweaks to the settings, click the Battery saver settings link at the bottom of the page.



↑ Battery saver is a new technology in Windows 10 that reduces the load on your laptop's battery automatically to help increase battery life

In this dialog box, you can choose to enable Battery saver automatically and choose the battery percentage when the feature is activated. The default setting of 20% should suit most laptops, but if your battery lasts a long time anyway, you may want to drop this to 15% or 10%; conversely, if your battery doesn't last very long, you may want to increase the setting to 25% or 30%.

The default setting blocks apps from pushing notifications (eating processor and battery time), but you can override this using the 'Allow push notifications' tickbox, although we don't recommend doing so. Your laptop's screen is a massive drain on the power of your laptop, so lowering its brightness can help improve battery life. For that reason, it makes sense to tick the 'Lower screen brightness' option, so your laptop will automatically dim the display when Battery saver turns on.

Finally, if you have an app that absolutely must run in the background and that you want notifications from at all times, you can use the 'Always allowed' section to allow this. Click the Add app button to see a list of apps you can add to the section; only full-screen apps

Your laptop's screen is a massive drain on the power of your laptop, so lowering its brightness can help improve battery life

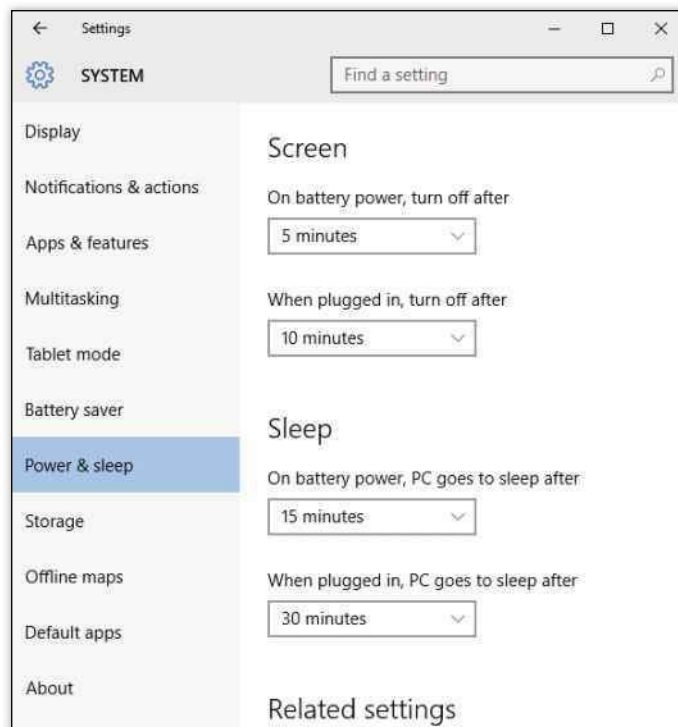


◆ You can allow certain apps to run all the time if they're really important

(not traditional Desktop applications) that support Battery Saver are listed: the Edge browser is an option, but Chrome isn't, for example.

POWER & SLEEP

Go back to the main Settings app and click on Power & Sleep to access the more traditional power-saving options. From this app, you can choose how long your laptop is inactive before its screen is turned off and when it should go to sleep. There are separate options for when it's plugged in and when it's on battery power. For most people, the default settings should be fine, but tweak them if you find that your computer is powering down too frequently.



◆ The Power & sleep option lets you choose when your computer shuts down the display

You can click Additional power settings to open up the old-fashioned Control Panel's Power Options settings (one of the few things Windows 10 hasn't quite integrated into the new apps). These settings let you choose or create a power plan, which is a set of defined settings that set how your laptop works. Balanced is the default plan; click Change plan settings to see what it does. The basic settings are the same as in Power & Sleep, only you can also set a default screen brightness.

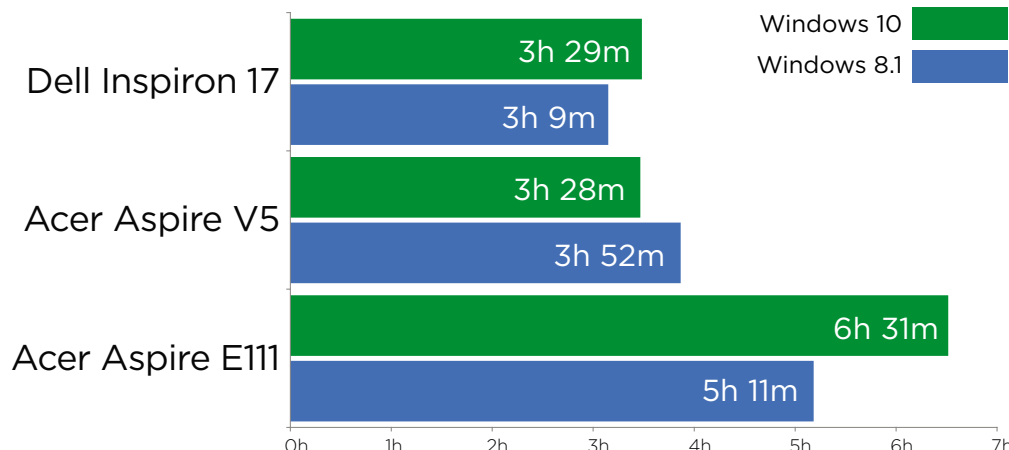
There's also an option called 'Change advanced power settings', which includes some really advanced settings, including controlling how the processor works. We'd advise you to steer clear of this section unless you really know what you're doing, however.

What does Windows 10 do for battery life?

To find out if the new Battery saver mode can help boost battery life, we tested three old Windows 8.1 laptops before and after we upgrading them to Windows 10.

With two of our laptops we were impressed to see that battery life improved after upgrading to Windows 10, not just by a little but by a full 80 minutes in the case of the Acer Aspire E111. The Dell Inspiron 17 managed a more modest 20-minute improvement, while the Acer Aspire V5 actually lost 24 minutes of stamina.

These results are in line with the anecdotal information we've seen, with some users



complaining of significantly reduced battery life with Windows 10, while others reported no significant change.

It's worth running your own tests at home, perhaps playing a video and seeing how long your laptop lasts with and without

Battery saver mode enabled by default to see if your laptop improves or decreases with this mode enabled.

How to... Use Windows 10's Safe Mode

As good as Windows 10 is, there will be times when it goes wrong and you'll need Safe Mode to fix an issue. Here's how to access it

WINDOWS 10 IS a great operating system and an excellent way to breathe new life into older systems, thanks to free upgrades for Windows 7 and Windows 8 users. It is, however, not without its problems, some of which will require you to boot into Safe Mode to help alleviate or fix them.

The process for doing so hasn't changed drastically from previous versions of Windows but, as the operating system can boot up faster

than before, it might require you to try different methods depending on your system and the current state of your operating system.

You may think that hitting F8 or Shift-F8 after your computer turns on will get you to the Safe Mode options, as in the past. Windows 10, however, boots up so much faster that this is no longer a reliable method (although it might still work if you're lucky). Fortunately, there are a few ways to access Safe Mode without breaking a sweat.

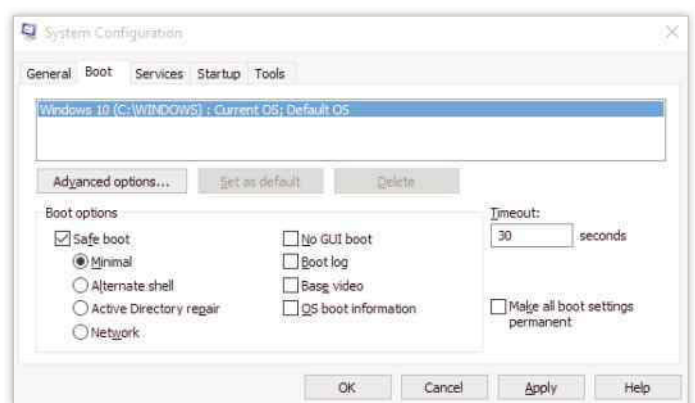
METHOD 1 Start menu

If your system is generally working fine and you are able to boot into the desktop, this is the easiest way to get to Safe Mode. First bring up Windows 10's Start menu and click the Power option. Hold down Shift on your keyboard and select the Restart option. Your system will now reboot into the Windows 10 recovery menu. After rebooting, you'll see the 'Choose an option' screen. Now select the Troubleshoot option at the bottom. From this screen, select Advanced Options, then the Startup Settings option, which should be the final option. You'll be presented with a screen telling you what settings can be changed after a restart. Hit the Restart button to reboot your system.



After a reboot you'll see a list of nine options. You'll want to use options 4-6, depending on what level of Safe Mode you require. Unless you know that you need a specific option, the first one, 'Enable Safe Mode', will be the right option for most people. To select your option, press the corresponding number key on your keyboard and the system will reboot in the applicable Safe Mode.

METHOD 2 System Configuration



Another option is to use the System Configuration menu. To get to this from the Windows 10 desktop, hit Win-R to bring up the Run menu. Type in 'msconfig' (without the quotes) and hit Enter. Navigate to the Boot tab at the top and tick the option marked Safe boot. Select the Network radio button if you want network access while in Safe Mode. If you select Alternate Shell you'll boot into Safe Mode with a Command Prompt running only critical system services. Active Directory Repair will boot Safe Mode with File Explorer open and critical system services. Usually, the Minimal option will be fine for most fixes.


Select Apply, then OK. You'll be asked if you want to restart now or later; doing so later will allow you to use your system as usual and boot into Safe Mode next time you restart. This method bypasses the 'Choose an option' screen detailed in Method 1 and goes straight to Safe Mode.

METHOD 3 Windows 10 Recovery Drive

If you're unable to boot to the desktop to use either Method 1 or Method 2, this might be your best bet. If you didn't have the foresight to create a recovery drive in advance, don't worry: you're not completely out of luck. If you have another system running the same version of Windows 10, you can use this to create a Windows 10 Recovery Drive using a USB drive.

On your working system, open the Start menu and search for 'Create a recovery drive'. It should be the first option in the results menu. On the next screen, make sure that 'Back up system files to the drive' is selected. Now run through the process and ensure you have a big enough USB flash drive. The wizard will let you know how much space you'll need. Note that you'll lose any existing data on the drive, so make sure you back up any content first.

With the flash drive inserted into your system, reboot and the system should boot from the USB flash drive. If not, you might have to

enter your system's BIOS first to tell it to boot from USB. This will differ depending on your motherboard's manufacturer, but usually requires you to hammer away at the Del or F2 keys as you turn the system on, and then ensure that your computer is set to boot from your USB drive first. Once you boot from the recovery drive you'll need to select the relevant keyboard layout for your keyboard. Now select the Troubleshoot option and follow the instructions for Method 1 to boot into Safe Mode. 



Business Help

If you have databases, office applications and macro issues, **Kay Ewbank** can help. Send your problems to businesshelp@computershopper.co.uk



Stop Word making images too big

Q I want to insert a picture into a Word document and have it fill the space. I want to keep the dimensions I choose for the image, rather than have Word use the picture's original dimensions. The space I'm allocating is different from the original size, but surely Word should be able to cope with resizing the image?

Stuart Armstrong

A The solution is to use a single-celled table. Set the row height and column width to fixed values, and any image you insert into the table will fit within those dimensions. If all your images have the same dimensions, you can create one copy of the table, then make multiple copies of the empty table before inserting your images.

The first step is to create a table using the Insert, Table command. Select the whole table, right-click and set the table properties to have

a preferred width of the value you need. (You can also use Table Tools, Layout, Properties to get to the same dialog.) You also need to click Options and untick the 'Automatically resize to fit contents' option. Set the height in the Row tab of the properties dialog, and you should find you can insert an image and have the frame remain the same size.

Now we come to inserting the image. Use Insert, Image, and choose the picture you want to insert. It will be pasted either with white space or with some parts of it not showing in the frame. Click on it, then select Picture Tools. In the right-hand pane of the ribbon, you'll see Size. Click on the arrow at the bottom right of this area, and you'll see the Format Picture dialog. Take the tick mark out of the option for Aspect Ratio, and set the height and width to be Absolute values equal to the size of your frame. You should now find that your picture is inserted as you want.



Signatures not working in Outlook

Q I've recently moved to Outlook 2010 from 2007, and I can't make the signatures option work. If I click on the Signatures button intending to click on the Signatures option in the email window, the dialog box doesn't appear. I used to be able to do this in 2007, and I can do it on my laptop (the problem is on my desktop). I've tried re-installing Outlook, but it doesn't help.

Daphne Clarke

A This is a problem that sometimes happens after upgrading Office, particularly if you have a security suite or virus scanner running while you're doing the install. The solution involves editing the system Registry, but you could try uninstalling and reinstalling Outlook again, this time making sure you've turned off your anti-virus program beforehand. If that doesn't work, you need to edit the Registry. The problem is usually that a particular Registry key is pointing to the old copy of Outlook rather than the most recent one. You need to know exactly where your copy of Outlook is stored on your machine, so before you begin

editing the Registry, use Windows Explorer to check it. You say you're using Outlook 2010, which would most commonly be found at: C:\Program Files\Microsoft Office\Office14\Outlook.exe. For other versions, Office 2007 is stored in Office 12; Office 2014 is Office 15.

Make a note of the full path for the file. Now on to editing the system Registry. As always if you have to edit the Registry, be careful as you can cause major problems to your machine if you get things wrong, so before opening the Registry, make sure you create a system restore point so you can go back to a working system if you run into problems. Press Windows+R to get up the Run command, type 'regedit' and click Run.

We're assuming you're using a 32-bit version of Office. So long as that is the case, you need to find the following key: HKey_Local_Machine\Software\Classes\CLSID\{0006F03A-0000-0000-C000-000000000046}\LocalServer32.

Select the key, and in the right-hand pane you should see a key named (Default). This should have a value that points to the location for your copy of Outlook.exe.

However, we suspect you'll find it points to one of the locations that no longer exists, which is what is causing the problem. If it isn't correct, right-click it in the right-hand pane and choose Modify. Change it to point to the correct location, then press OK.

If the key is missing, you can create it using Edit, New, Multi-String Value. Once you've exited the Registry editor, you should find that you can now create and edit signatures. However, if you don't want to edit the Registry, or if you're not allowed to because you don't have administrator rights, you can actually edit your signature files directly. There are three signatures, one for plain text, one for HTML format, and one for Rich Text.

What you need to do is to look in the Users folder on your main drive. In there you'll find a folder with your name, and inside that should be a folder called AppData\Roaming\Microsoft\Signatures. If you look in here, you'll see your signature files. Click on the one you want to change, right-click and choose Edit. The signature will open, either in Word or in Notepad depending on the format, and you can make your changes directly.

XY charts in Excel

Q I've been asked to create an XY chart in Excel with text labels above each point on the graph. I can't see where the setting to do this is in Excel 2010.

Richard Ashford

A The reason you can't find it is because there isn't an automatic way to do it. Excel assumes that points on XY charts don't have text labels. If you want to add them there are two options. First, there's a freeware add-in called XY Chart Labeler that you can use. If you prefer not to use third-party software, the only solution is to use a macro.

The method below assumes your data is stored in the range B2:C10, with the labels you want to use in A2:I10. Select the data and insert your XY chart using Insert, Scatter. Select the most appropriate type of chart from the choices on offer. To make life easy for the macro, move your chart to a new sheet of its own. To do this, on the Chart menu choose Design (in the Location group). Click New Sheet, then click OK.

Press Alt+F11 to start the Visual Basic Editor (or choose Developer, Visual Basic). On the Insert menu, click Module, and type in the code below:

```
Sub AddLabs()  
    Dim Cnt As Integer, xVals As String,  
        xstart As Integer, xend As Integer  
    Application.ScreenUpdating = False  
    xVals = ActiveChart.SeriesCollection  
        (1).Formula  
    xstart = InStr(1, xVals, ",") + 1  
    xend = InStr(xstart, xVals, ",") - 1  
    xVals = Mid(xVals, xstart, xend -  
        xstart)
```

```
For Cnt = 1 To Range(xVals).Cells.  
    Count  
    ActiveChart.SeriesCollection(1).  
        Points(Cnt).HasDataLabel = True  
    ActiveChart.SeriesCollection(1).  
        Points(Cnt).DataLabel.Text =  
        Range(xVals).Cells(Cnt, 1).Offset  
        (0, -1).Value  
    Next Cnt  
End Sub
```

Choose File, Close and return to Excel. Make sure the chart sheet is visible, then choose Developer, Macro and select the AddLabs macro. Run it, and you'll find your labels get added to the chart.

The macro falls into two parts. First we need to find the location of the left-hand range used in the graph – the X values which in our case are in B2:B10, but could be located anywhere so long as the text to be used as labels is immediately to the left.

The line:

```
xVals = ActiveChart.SeriesCollection  
        (1).Formula
```

gets the value of the first series in the graph as text. In our case this returns:

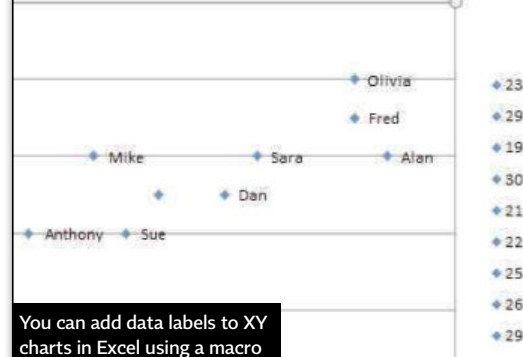
```
SERIES(,Sheet1!$B2:B10,Sheet1!$C2:C10),  
1)
```

We want to extract:

```
Sheet1!$B2:B10
```

To do this we look for the first comma – the one following SERIES(.

We add one to that location to avoid



You can add data labels to XY charts in Excel using a macro

taking the , itself. This is stored in xstart using:

```
xstart = InStr(1, xVals, ",") + 1
```

Next, we want to find the next comma – the one after the B10. To do this, we start looking from xstart. Having found the location of the next comma, we subtract one from the location to avoid taking that comma:

```
xend = InStr(xstart, xVals, ",") - 1
```

Now we can get the range using Mid, starting from xstart, and taking xend-xstart characters:

```
xVals = Mid(xVals, xstart, xend - xstart)
```

The other key part of the macro adds the text. The loop is run through as many times as there are items in the series using range.cells.count. For each element in the range, the HasDataLabel property is set to be true, and the value for the text property is taken from the cell one to the left of the series value using the Offset function:

```
For Cnt = 1 To Range(xVals).Cells.  
    Count  
    ActiveChart.SeriesCollection(1).  
        Points(Cnt).HasDataLabel = True  
    ActiveChart.SeriesCollection(1).  
        Points(Cnt).DataLabel.Text =  
        Range(xVals).Cells(Cnt, 1).Offset  
        (0, -1).Value  
    Next Cnt
```

Set autocomplete values in Access

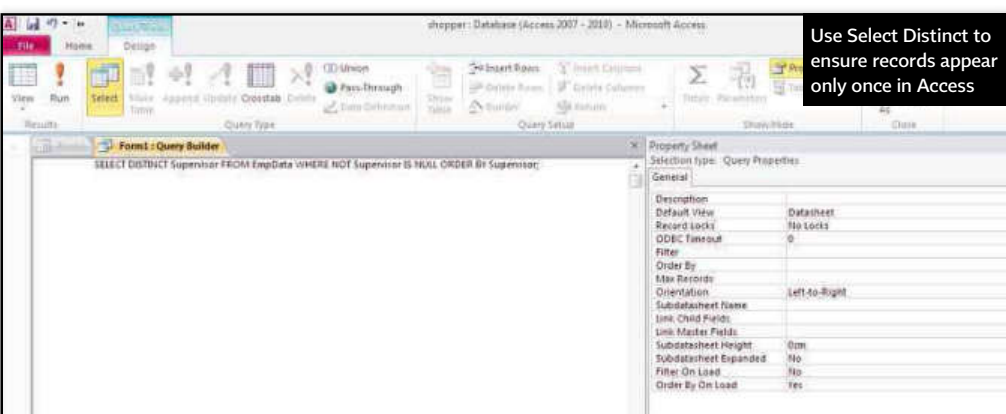
Q When people leave our company, we have a set of rules about what should happen: their email address should be closed, we retrieve their door entry card, remove them as users on various databases and so on. I want to use a database form with a check list to make sure everything has been carried out. Ideally, I want to have quick ways to enter information such as their department and supervisor. I

realise this would ideally already be available in their employee record, but that's all locked into a closed system that I can't access. Is there a way to complete information automatically as the details of supervisor, department and so on are entered? I have the data type set to text, and the row source type set as table/query. How can I get the information appearing in Access 2010?

John Annison

A The answer is a combination of using a DLookup function and a combo box. If you set the display type to be a combo box, and set the AutoExpand property to Yes, your users can begin typing the name of the supervisor and the name will appear if it has already been entered. When it comes to the department, we think you should have all the departments already set up so it's just a straightforward combo box choice. Your Combobox RowSource should look something like this: SELECT DISTINCT Supervisor FROM EmpData WHERE NOT Supervisor IS NULL ORDER BY Supervisor;

You need to replace 'Supervisor' with whatever the name of your actual field is, and replace 'Empdata' with the name of the table or query you're pulling the data from. The use of SELECT DISTINCT prevents entries appearing more than once. **CS**



Helpfile

Whatever your general PC, hardware and software woes, **Simon Handby** is here to help. Send your problems to help@computershopper.co.uk



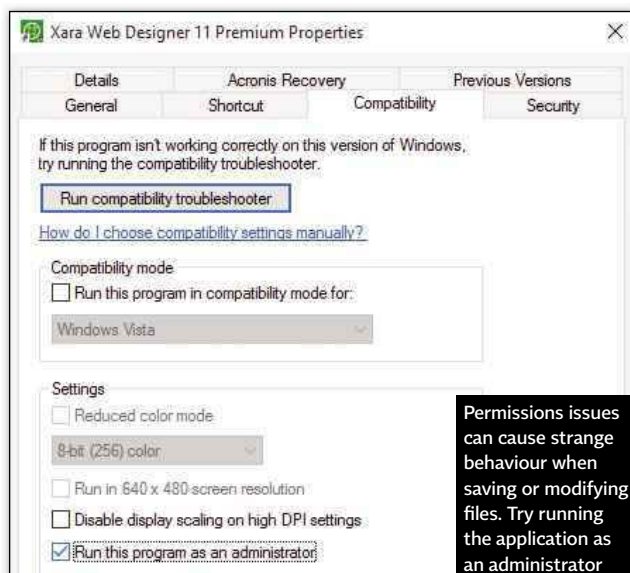
Where have my changes gone?

Q After updating to Windows 10 in early August everything seemed to have gone perfectly well.

Today I opened a file in PagePlus X8: I know I'd worked on it quite extensively yesterday, but mysteriously nothing I'd updated was there. On checking the file date it was one week ago, rather than yesterday. My first thought was that I had somehow forgotten to save it or saved it in the wrong location, but when I used Explorer's search function it found a file apparently in the correct folder, with yesterday's date and containing all the correct changes. It's as if the system is holding two versions of the same file.

I've since played around with file saves and discovered that if there is a file of the same name sitting in the folder, then it doesn't appear to be updated when I save it. If I save my changes as a new file this can be written and updated successfully. Aside from my Windows upgrade, the only other recent change to my system was an upgrade from a hard disk to an SSD about three weeks ago. Can you tell me what's going on?

Keith Briffett, keith.briffett@uwclub.net



A That's a curious problem, but we've seen similar issues before when an application doesn't have the necessary permissions to modify files. The first thing we'd suggest is a test: instead of starting PagePlus X8 normally, navigate to it

via the All apps option on the Start menu, right-click it and select Run as administrator. From PagePlus, update your document, save it again, then close PagePlus and re-open the document.

If this works as expected, it does suggest a permissions issue, possibly caused by the upgrade to Windows 10. It's likely that as PagePlus can't modify the original file, Windows is creating a second version which is held in a virtual store and mapped to the original location. To return it to its correct place, search for the file as you have been doing then simply cut and paste it into the correct folder, overwriting the file that PagePlus couldn't update.

If the problem persists, you can modify PagePlus X8 so that it always runs with administrator permissions: right-click the shortcut you're using to launch it and select Open file location, then right-click that shortcut and select Properties. On the Compatibility tab, tick 'Run this program as an administrator', and click OK.

Update? Not if I can help it

Q I upgraded my Windows 8.1 laptop to Windows 10 and I have to say it's a massive improvement. One thing is bugging me, though – I've always preferred to choose whether and when to download Windows updates, and the only options I've got in Windows 10 are to do it all automatically, or 'Notify to schedule restart'. Is there a way to get more control?

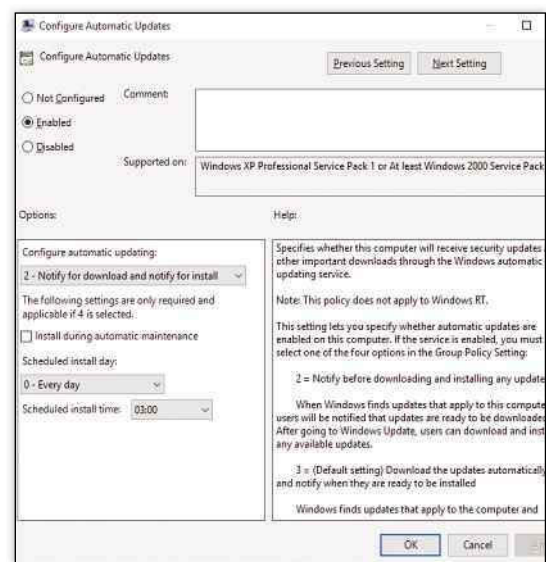
Jason Hopkins

A In Windows 10, Microsoft has deliberately removed the options to either not install updates at all, or to manually choose when to download or install them. Most users probably weren't aware they even existed, but for those who used them it's easy to get control back on any edition except Windows 10 Home.

Start by opening the Start menu, typing `gpedit.msc` and selecting 'Edit group policy' in the results. In the group policy editor, expand Administrative Templates under the Computer Configuration heading in the left-hand pane, then under Windows Components select Windows Update.

Double-click Configure Automatic Updates, and in the dialog box that appears select the Enabled radio button, then underneath select 'Notify for download and notify for install', then click Apply.

The Home edition of Windows 10 lacks the group policy editor. You can download a third-party installer that will add it from tinyurl.com/gpeditor. We've tested this and it does appear to work in Windows 10, but note that using it is likely to be a breach of Microsoft's licensing agreement.



You can prevent automatic updates in Windows 10, but it's a well-hidden option

Is there an XP mode in Windows 10?

Q I'm planning to upgrade my Windows 8.1 laptop to Windows 10. I'd also like to upgrade my main desktop PC, which runs Windows 7 Ultimate, but I'm concerned that if I do I won't be able to run my legacy XP programs which currently work in XP compatibility mode. Am I right in thinking there isn't an XP compatibility mode in Windows 10 and, if so, is there an alternative?

Glyn Foster, glyn.s.foster@gmail.com

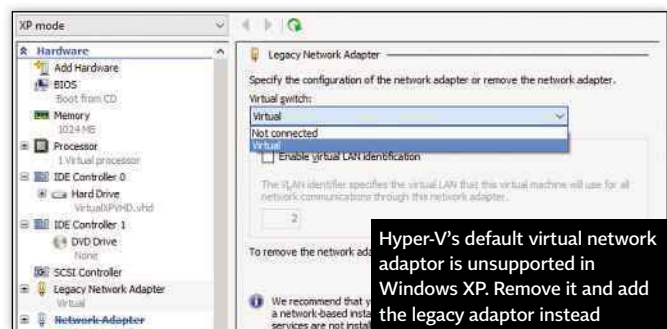
A Windows Vista is the earliest operating system to appear among the Program Compatibility Troubleshooter options in Windows 10. Windows XP mode isn't officially supported, either, but it is possible to set up a Windows XP virtual machine if you don't mind a bit of hassle. Start by visiting tinyurl.com/xpmodeinstaller and downloading the Windows XP Mode installer. Select the top option of the two versions available, which includes Windows Media Player. You'll also need a program to handle more advanced zip file operations than Windows offers: we used 7-Zip, which you can download free from www.7-zip.org/download.html.

Assuming you've already upgraded your Windows 7 PC to Windows 10, open the Start menu and type 'change or remove' (without the quotes), then select Change or remove a program in the results. In the applet that opens, click Turn Windows features on or off, then tick the box next to Hyper-V, click OK and reboot your system when prompted. After rebooting, install 7-Zip. Once that's

finished, right-click the XP mode file that you downloaded, select 7-Zip, and select 'Extract to WindowsXPMode_en-us\'. This will extract files into a folder within the same location as the downloaded file.

Browse this folder, open the Sources folder within it, right-click 'xpm', select 7-Zip then select Open archive. Select the VirtualXPVHD entry and click the Extract button, then provide a sensible location such as C:\Virtual XP\. Once the file has been extracted, you need to rename it to add the .vhd file extension, such as VirtualXPVHD.vhd. Now click Start, type hyper and run Hyper-V Manager in the results. Select your computer under Hyper-V Manager in the left-hand pane, then click Virtual Switch Manager... in the right-hand pane and create a new External virtual switch, accepting all the default settings.

With this done, click the Action menu, click New, select Virtual Machine... and click Next in the dialogue that opens. On the following pages, name the machine XP Mode (or something else suitable), select Generation 1, accept the default memory, leave the network as 'Not Connected', then choose to use an existing virtual hard disk and browse to the one you extracted and saved earlier. Now click Finish to create the virtual machine, which should become visible in the Hyper-V Manager.



Select it and click Settings, then in the left-hand pane select Network Adaptor and click Remove. Now select Add Hardware in the left-hand pane, select Legacy Network Adaptor, click Add and use the drop-down box to connect this new adaptor to the switch you created earlier, before clicking OK to save all your changes. Now click Connect to connect to the virtual machine, then click the green power icon to start it.

Finally, delete the WindowsXPMode_en-us.exe file and the contents you extracted from it, but don't delete the VirtualXPVHD.vhd file you saved. When you run the virtual machine you'll need to finish the last few steps of a typical XP installation, after which it should work like a normal XP computer. Remember you'll need to provide a product key to activate Windows XP, and you should protect the installation by downloading all the available updates and installing anti-virus software. You could also configure a backup, although if you regularly back up the host PC this should also back up the virtual machine.

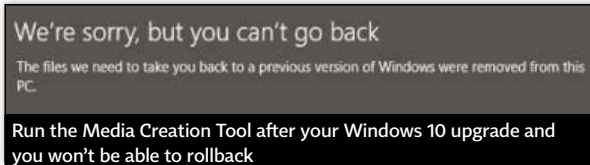
You can never go back

Q A few days ago I upgraded my desktop from the original Windows 7 to Windows 10. I read the article in your October issue which suggested I subsequently make a Windows 10 install disc, so I followed your useful guide to download the Media Creation Tool, download the Windows ISO image and burn it to a DVD.

However, I have since found that Pinnacle Studio 15, the video-editing software I use, seems to be incompatible, so I wanted to rollback to Windows 7. When I tried to do so I got the message "The files we need to take you back to a previous version of Windows were removed from this PC". It's only a few days since I upgraded to Windows 10 so I'm well within the month period during which rollback is meant to be available. On searching for a possible explanation, it seems the Windows.~BT folder is required for the rollback, but this is overwritten if the Media Creation Tool is run. Now I can't get back to Windows 7, and I can no longer use my video-editing software. Grrr!

Alastair Pink, agpink@btinternet.com

A You're right that the Windows.~BT folder is needed for the rollback, but rather dumb-headedly its contents are destroyed if you run the Media Creation Tool. However, it's likely that you'll be able to get around this in one of several ways.



If you took a backup in the gap between the upgrade and running the Media Creation Tool, you should be able to restore the Windows.~BT folder from that. Alternatively, if you have a friend with Windows 7 who has also upgraded to Windows 10, grab a copy of their folder and copy it over your own. Our tests suggest that simply copying the contents back into the folder in this way is enough to enable the rollback to complete successfully. It shouldn't hurt to try, but it's a good idea to take a full system backup first just in case.

Things are less promising if you can't get a copy of the folder or the rollback still doesn't work. We've seen it suggested that you try to restore the earliest Windows 10 restore point and then rollback, but we haven't found anyone who can confirm that this will work. To try it, open the Start menu, search for recovery, open the Recovery app, click Open System Restore, select Choose a different restore point, click Next, tick Show more restore points, and see if any post-date the upgrade, yet pre-date your running of the Media Creation Tool. If so, restore, then try to rollback the PC.

If this doesn't work you'll need to restore from a backup taken before you upgraded the PC, or if you don't have one you may need to re-install the PC from scratch. In either case, take a backup first so you don't lose any work you've done since your upgrade. ☹

Make your own music-streaming service

As long as you have a NAS and an internet connection, you can stream your music to wherever you are for free. **Clive Webster** shows you how



WITH APPLE AND Google joining the likes of Spotify and Rdio, music streaming is now thoroughly mainstream. Although these services offer you more music than you could ever listen to, you either have to pay a subscription or else suffer jarringly awful adverts in between your chosen tracks. Even worse, should the service cease, fold, change or be bought out, you might be frozen out of your online music altogether. Instead, why not just make your own free service from your own music collection and listen to that wherever you are in the world? All you need is a network-attached storage device (NAS) and a broadband connection.

First, you'll need somewhere to store your music – a NAS, to be precise. As we've often recommended Synology DiskStations in the past, this article will use a DiskStation and Synology's apps, though most major NAS manufacturers offer similar music-streaming capabilities to Synology.

Your broadband connection will also need a reasonably fast upload speed. To check yours, run a test at www.speedtest.net. Our ADSL upload speed was measured at 0.85Mbit/s, which should be plenty for MP3 files. Typically the highest bit rate you would use to rip MP3s is 320Kbit/s (0.32Mbit/s), but 192Kbit/s (0.19Mbit/s) or 160Kbit/s (0.16Mbit/s) is more common.

If you can't remember how you've encoded your audio files, you can analyse a few files for their length and file size. For example, a 4m 11s track taking up 4.9MB of disk space has an average bit rate of 0.16Mbit/s; the maths is to multiply the file size by eight to convert megabytes to megabits, and then divide by the length of the track in seconds.

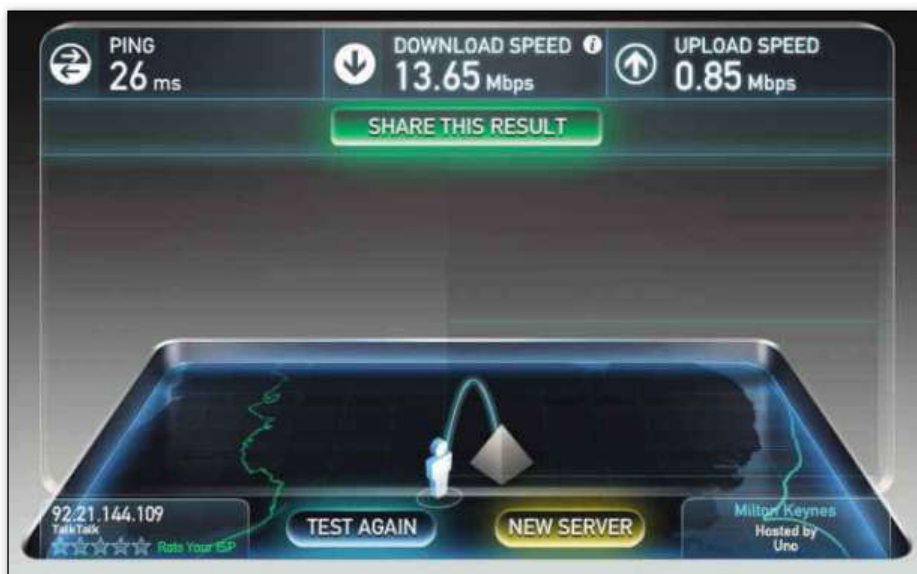
While MP3s and similar lossy formats should pose no problem for a halfway decent broadband service, lossless formats such as FLAC can generate files with around a 1Mbit/s bit rate. High-resolution audio files might have a bit rate of 4.6Mbit/s or more, in which case you'll either need a very fast upload speed, such as that from a fibre broadband connection, or else will need to dabble in transcoding (see the box on page 138).



↑ Listen to your music anywhere, for free, with Synology's DS audio app

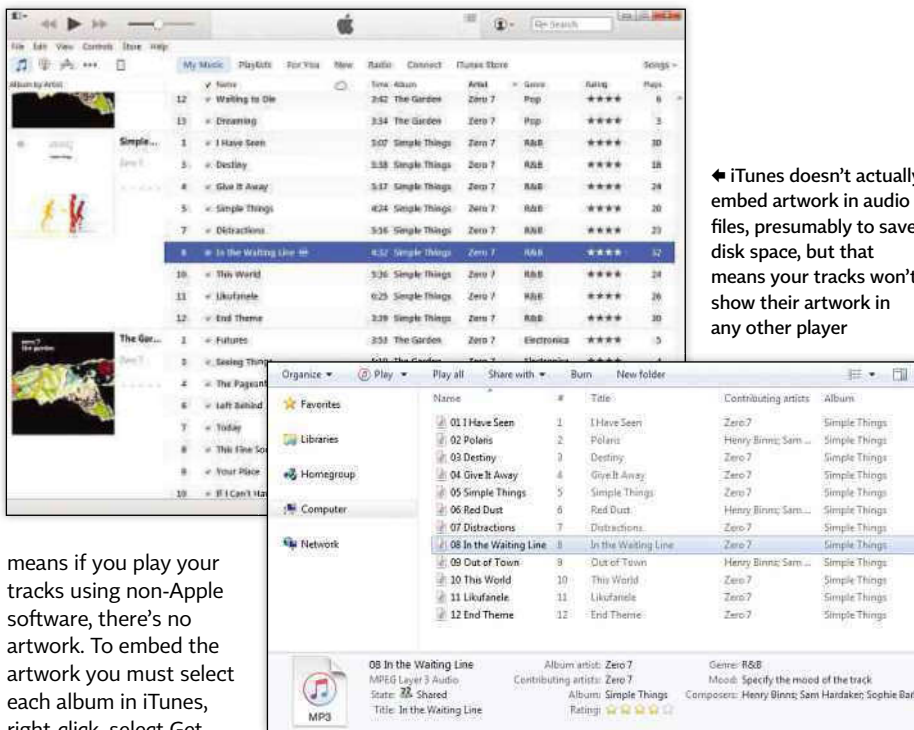
HEAVY META

After you've updated your DiskStation and installed Audio Station you're ready to copy your audio files to the music folder of your NAS. How best to do this depends on your music playback software, with some players very adept at embedding metadata – artwork, track names, play counts and so on – and others hopeless. For example, iTunes embeds metadata such as track name, album name and artist, but doesn't embed artwork. Instead, iTunes stores artwork in a proprietary format in a separate folder to your music. iTunes combines the audio file with this separate artwork file, giving your tracks their artwork while minimising storage space. This



↑ Your broadband connection will need at least a 0.5Mbit/s upload speed to stream music from your home

Some music players are very adept at embedding metadata – artwork, track names, play counts and so on – while others are hopeless



means if you play your tracks using non-Apple software, there's no artwork. To embed the artwork you must select each album in iTunes, right-click, select Get Info and then paste an artwork image you source yourself into the empty frame of the Artwork tab.

Thankfully, there's a quick way to sort out your music library and make it ready for the Synology DS audio app. Install MusicBee (see getmusicbee.com/download.html) to automatically update the tracks now stored on your DiskStation. You can either import your library from iTunes or Windows Media Player, or point MusicBee at the folder containing your music files. If you don't want to make any changes to your 'main' music library, copy the library to your NAS and then point MusicBee at the NAS directory via the Add Network Location tool. Adding missing artwork to your library is easy: open the main MusicBee menu, click Tools, Tagging Tools, Show Files with Missing Artwork. Highlight all these files with Ctrl-A, and then select Tools, Download Artwork from the MusicBee menu. Tick the 'album covers' option and click Preview. For each album you'll be offered up

to four options, so choose the best image for each album and then click Save All.

If you use iTunes, or another player that saves track ratings as a separate .xml file, you can also import track ratings. Log into your DiskStation, open Audio Station, click Settings, Options and 'Import iTunes Song Ratings' to find the iTunes Music Library.xml file in your Music/iTunes folder. Annoyingly, you can't import your iTunes playlists.

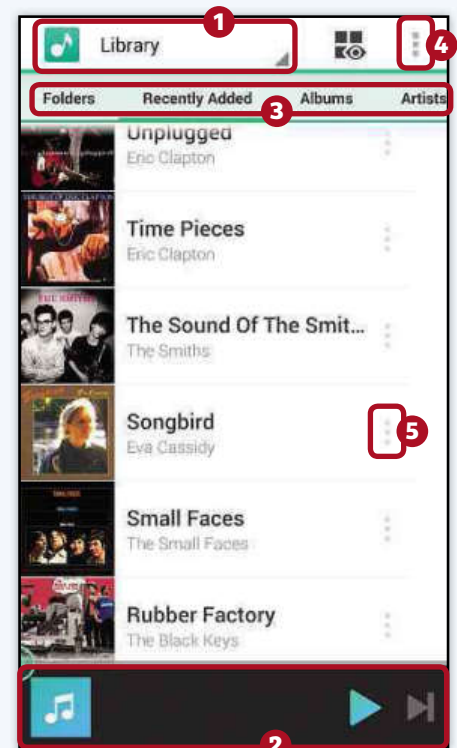
Now install Synology's free DS audio app on your smartphone. The app is available for Windows Phone as well as Android and iOS. The DS Audio app should be able to auto-discover Audio Station running on your NAS, so use your NAS's log-in credentials to access your music. If it can't find anything, log into your DiskStation's admin interface and check Audio Station is running. If it isn't, go into the Package Center and install or update it to the latest version. Once connected, you should see your music library. To check your phone

MUSIC APPS GUIDE

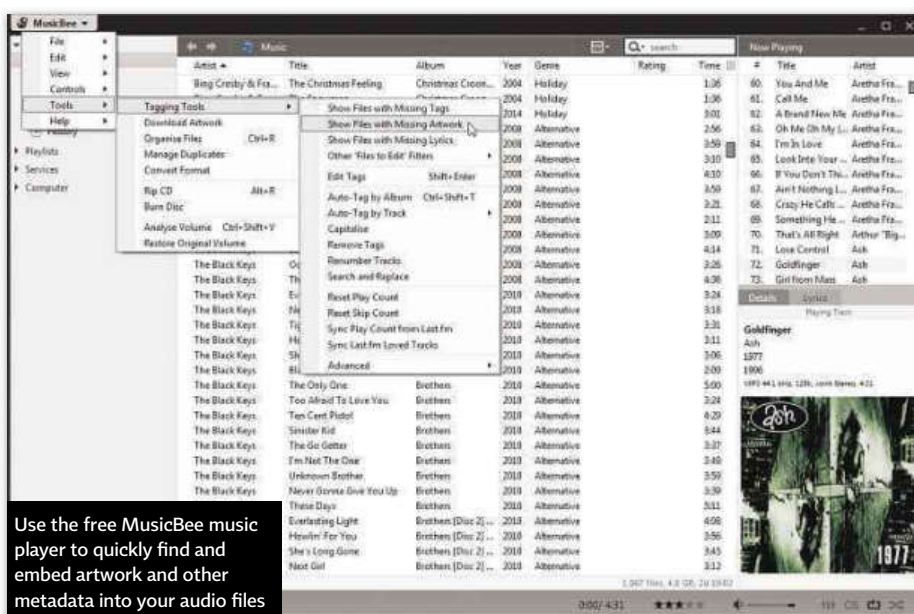
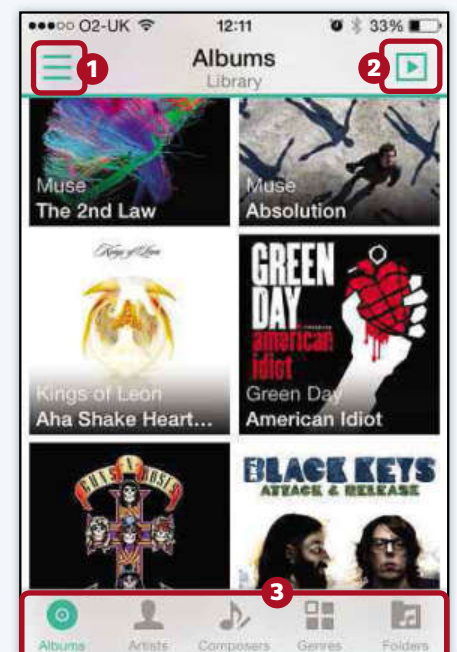
Synology's DS audio music-streaming app has a host of options to organise, select and otherwise control what you listen to. Here's a quick guide:

- 1 Playlists, Radio, Library, Downloaded Songs (Settings, iOS)
- 2 Quick play
- 3 Categories
- 4 Settings and miscellaneous functions
- 5 Album quick-play options

ANDROID



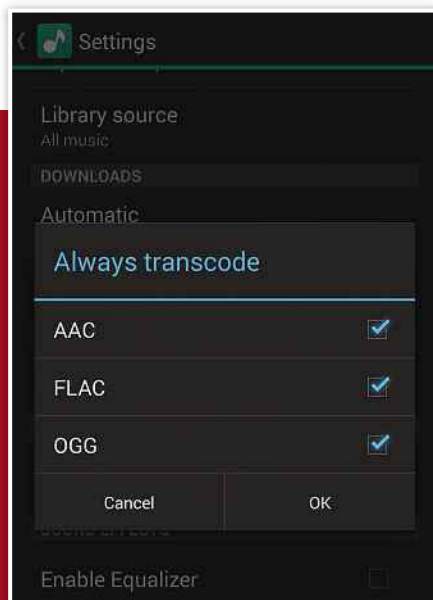
iOS



Transcoding

If your broadband can't cope with the bit rate of your audio, you'll have to dabble in on-the-fly transcoding. Transcoding is the process of creating a copy of a digital file in a different format, for example creating an MP3 version of a track originally created as FLAC. This is useful to achieve compatibility (an MP3 version of a song should play on any device) or to reduce file sizes (to make for smooth streaming over your broadband connection). Remember also that streaming a lower bit rate version to your phone will consume less of your mobile data allowance and could improve reliability by decreasing dropouts. Transcoding on the fly automates the encoding process, creating a temporary version of the original file to stream, which is deleted after playback.

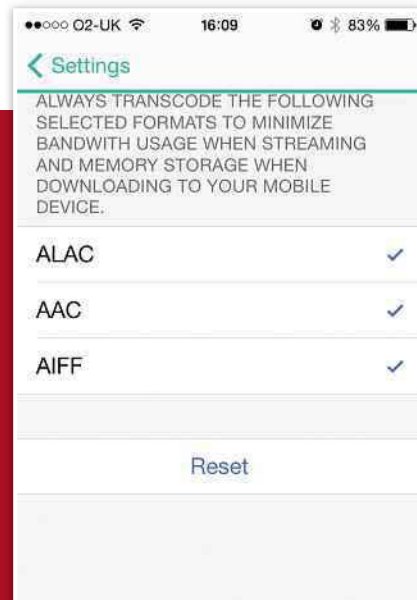
Depending on your broadband and the size of your audio tracks, you'll either want to deploy transcoding on your DiskStation or on your phone (if you're using another manufacturer's NAS, you'll need to see what other options are available). If your files are too large for your upload speed, dive into Audio Station on your NAS, click



↑ Use your phone to order your NAS to transcode your audio to minimise dropouts and reduce data usage

Settings, Advanced, and then tick the box next to 'Enable audio transcoding for DLNA devices'. If you still encounter problems, also tick the box next to 'Downsample audio files for better DLNA compatibility'.

If your home broadband's upload speed is plenty for your audio files, but you want to stream to a phone that is out of range of Wi-Fi and reliant on 3G, you can use the



phone's app to order your DiskStation to transcode tracks; open the menu, tap the cog icon and scroll down to the 'Always transcode' option. Tap this, and then tap the file formats you wish to transcode (the less common 'ALAC' abbreviation is used instead of 'FLAC'). Once you're back on Wi-Fi, you can deselect the file formats and enjoy your high-quality audio again.

can stream music from your NAS over your home network, tap an album and then a song from that album; after a second or so, your phone should start playing the track.

REMOTE ACCESS

Streaming music over your home network is useful enough; you can use the DS audio app to send music streams to all kinds of devices around your home, such as anything that supports DLNA, Bluetooth or Airplay, which is pretty much anything with a LAN port or a Wi-Fi aerial. However, you need to do a little more fiddling to listen to your music over the internet while you're out of the house.

Log back into your DiskStation and open the Control Panel, then open QuickConnect.

Tick the box next to 'Enable QuickConnect' then click the link to 'Log in or register a MyDS account'. If you need to create a MyDS account, fill out the form that appears.

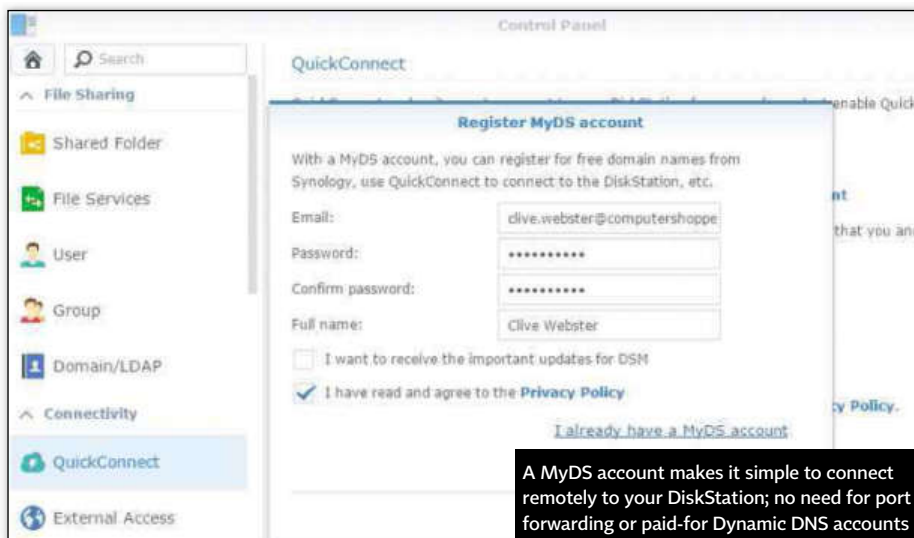
Once you've clicked OK you'll be emailed an activation link. Go back to QuickConnect and create a QuickConnectID for your DiskStation; we used 'cs-syn1'. If you agree to

Type the URL into a web browser, log in with your NAS login credentials and you'll gain full control of your DiskStation from anywhere you can get online

Remember that this email and password combination could give someone full access to your DiskStation, so use a strong but memorable password.

the terms of service and the privacy policy, you can tick that box before clicking Apply. After a few moments of processing, the QuickConnect screen should update to show a URL in the format <http://QuickConnect.to/<your-nas>> and a QuickConnect ID. Type the URL into a web browser, log in with your NAS login credentials and you'll gain full control of your DiskStation from anywhere you can get online.

To start streaming audio, launch DS audio and type your QuickConnect ID (not the URL) into the location field before tapping Login. If you use your QuickConnect ID rather than the DiskStation's IP address, the DS audio app should automatically switch between Wi-Fi and mobile-data streaming as necessary.



A MyDS account makes it simple to connect remotely to your DiskStation; no need for port forwarding or paid-for Dynamic DNS accounts

NEXT MONTH

AUDIO-CONTROLLED CHRISTMAS LIGHTS

Make your tree lights extra jazzy this year as they react to different types of music

Using professional printing services

Whether it's for newsletters, stationery or Christmas cards, a professional printing bureau is often your best option. **Ben Pitt** explains what's involved



HOME PRINTERS ARE great when you want to make a few quick copies of something, but when print runs involve hundreds of copies it all becomes much more laborious. The paper input and output trays need constant monitoring. The printer randomly reports that an ink cartridge is empty, even though you know there's still enough for dozens more pages, so you stand over the printer watching for streaky colours. When it's time to replace a cartridge, you discover the colour you need is the only one that's not there. Then there's the rigmarole of collating and folding multiple-page documents without getting the pages mixed up.

It doesn't have to be this way. Upload your design to a commercial printing service, select how many copies, the paper quality and finish you want and – typically within 48 hours – you'll have the prints delivered to your door.

The cost of getting it done professionally is also often less than printing at home. Domestic printer ink is one of the most expensive substances known to man, at around £1 per millilitre. Per-page print costs range from 3p to 10p for a full-colour A4 page. These figures are based on tests using business graphics documents with a mixture of text and diagrams. If your document has lots of images or a coloured background, ink costs are likely to be much higher. Double the cost for two-sided printing, add a further 1p per page for paper – or more if you want better-quality paper – and you're looking at anything from 10p to 25p per A4 print.

Printing bureaux work out cheaper for larger print runs. For a double-sided A4 print on economy paper you might pay around £25 for 250 copies – roughly the same as doing it at home. However, 1,000 copies might be £50 (5p each), while 10,000 might be £250 (2.5p each). It also helps that certain types of print jobs aren't subject to VAT (see page 140).

Even for relatively small print runs where

Order a free sample pack to help get your head around the myriad paper grades and finishes



there isn't a significant cost saving, it's likely you'll achieve a better result with a bureau. Professional printers can print right up to the edges of the page – something that domestic inkjets can do for photo paper but not usually for other types, and certainly not at high speed. You can choose sizes from A7 to A0, square leaflets and flyers, business cards, greeting cards, compliment slips and all sorts of other shapes and sizes. There's usually a wide range of paper grades available, and additional services such as folding, stapling and laminating are all part of the service. Some companies offer customisable design templates, while others offer a bespoke design service paid by the hour, so you can get something polished and professional for very little effort.

SHOPPING AROUND

There are lots of printing bureaux available, and it's worth doing some research to find the right product at the right price. A Google search for 'printing services', 'leaflet printing' or some other choice words will throw up dozens of matches and you can begin to compare prices. Watch out for folded paper sizes – some companies

quote prices for the folded size, while others quote for the opened-out size.

It can be tricky to navigate all the options, particularly when it comes to paper types and finishes. Some printers charge a significant premium for matt or gloss finishes compared to uncoated, while others charge the same regardless. That's because some finishes are dependent on the paper type, while others use a lamination process after printing. You can also choose from recycled paper and specialist finishes such as iridescent.

The best way to navigate these options with confidence is to request a sample pack. These include a range of paper types, weights and finishes offered by that particular printer, so you can compare them directly.

Turnaround times vary. Urban Design & Print (www.urbanprinting.co.uk) offers next-day delivery if you place the order by 4.30pm. Instantprint (www.instantprint.co.uk) has a two-working-day turnaround for orders placed by 5pm. Saxoprint's (www.saxoprint.co.uk) standard delivery is five working days, although there are options for faster turnarounds. These variations are



generally reflected in the price charged, so if you're not in any rush this is an easy way to reduce your printing costs.

Also consider customer service. Most commercial printers allow artwork to be uploaded and the print job to be defined using an online form, but it's often helpful to be able to discuss your requirements with a human being. We'd recommend giving the company a call to discuss the details of your job. If you can't get through or don't get a helpful response, it doesn't bode well for if you run into problems later on.

PREPARING YOUR ARTWORK

One advantage of printing at home is that you can run off one copy and see how it looks. If you're paying for 1,000 copies up front you want to be sure that your print job is going to come out right.

You don't have to leave it all to chance, though. Many printers can send you an electronic proof, which is typically a PDF that they use to print. This can help to identify any glaring problems such as colours that haven't converted properly or text that's cropped off the bottom of the page. However, these are less useful if you want to check colours. Colours can look very different on a monitor compared to print, and vary from printer to printer too. You won't learn much about colours by checking a proof on the same monitor on which you designed the artwork. For added assurance you can usually order a printed proof to be posted, although this will inevitably increase the cost and lead time for the job.

We spoke to Phil Foster, key account manager at Saxoprint, about the proofing process. He explained that all submissions get a standard artwork check, which will usually pick up glaring errors such as very low-resolution images. For an additional £14, clients can request a Superior Check, which



The KBA C16 commercial press – you know it's a serious printer when it comes complete with a flight of stairs

will flag up any issues regarding embedded fonts, RGB colour conversion and so on – more on these points below.

SIZING UP

It's crucial that the design is the right size for the format you've chosen. If it isn't, the printer may simply adjust it to fit and part of the design may be cropped off. Many printers provide template documents in popular formats such as InDesign, Photoshop and Illustrator that you can download and use for the basis of your design. Saxoprint goes a step further and offers an InDesign plug-in so that templates can be accessed directly from inside the software.

If there isn't a suitable template available, it's not hard to make one yourself. First of all,

check the measurements of the printed document, which should be shown on the website you're planning to order from. If the specification of a folded document isn't clear, phone or email for clarification.

Next, you need to think about bleed. This is a margin (usually 3mm) around the edge of the printed area. Bleed is important because of the way in which commercial printers create documents with colour right up to the edge of the page. The printer can't actually do this, so instead, designs are printed on to oversized paper – usually much larger with multiple copies side by side – and the paper is cut to size after printing. This printed area isn't always perfectly aligned with the cut area, so a 3mm bleed area provides a margin of error. Any background colours and images need to extend all the way to the edge of the bleed area; there's no point in creating a bleed if you don't use it.

For the same reason that you need a 3mm bleed extending beyond the edge of the paper size, you should also allow for a 3mm safety area on the inside edge of the paper dimensions. This safety area shouldn't include text or anything else that would look wrong if it were cropped by a slightly misaligned cut. In practice the tolerance for printing and cutting is usually much better than 3mm, and many printers only require a 2mm bleed, but even so it's good practice to allow 3mm either side of the page edge.

Most ready-made templates include marked-out bleed and safety areas, but they're easy to create from scratch, too. Desktop publishing software such as Adobe InDesign and Xara Photo & Graphic Designer understand what a bleed is, so it's a simple matter of switching the option on and setting the bleed width when defining the page size.

If you're starting a document from scratch in a bitmap editor such as Photoshop or

Paying VAT?

Some types of printed materials aren't subject to VAT. According to www.gov.uk, brochures, leaflets and pamphlets come under the same VAT exemption as books, magazines and newspapers. Search for 'VAT Notice 701/10' for the official guidance.

The rules are quite complex. For example, anything larger than A4 (when folded) is likely to count as a poster, which is subject

to VAT. Calendars and tickets aren't exempt, and neither are manuals or documents with areas that need to be filled in.

Saxoprint provides a useful summary with further examples at www.saxoprint.co.uk/vat. If it all seems too baffling, the chances are the printing bureau will be able to advise you – or they'll just decide whether to charge VAT after looking at your artwork.

We once had some flyers printed for a concert that didn't require VAT, but the next time we used the same service, we were charged VAT. The difference was that the second flyer stated that people received a discounted entry.

✦ Check online to see if your printed document will be subject to a VAT charge



Photoshop Elements, establish the required page size and then add 6mm to these dimensions to create the 3mm bleed around the document. You'll also need to set the resolution in dots per inch (dpi). 300dpi is standard for printing, but it might be worth editing at a higher resolution such as 600dpi. Most bitmap editors are destructive, in that the image information is altered each time you make an edit. Repeatedly resizing an image adds small quantisation errors each time, and this can eventually take its toll on details. Editing at 600dpi and resizing down to

the bleed as a red line that's independent of the page size, but in Photoshop Elements you just have a blank canvas.

The easiest way to define the edge of the page and the safety area is with guides. These are lines that can be switched on and off and won't appear in print. To create a guide in most design applications, simply drag from the Ruler along the top and left edges of the canvas on to the document. You may need to make Rulers visible first; you can find this option in Xara's Window menu or in Photoshop Elements' View menu.

It's crucial that the design is the right size for the format you've chosen. If it isn't, the printer may simply adjust it to fit and part of the design may be cropped off

300dpi at the end should mean that these errors aren't noticeable.

Illustration and desktop-publishing software doesn't have this problem, as resizing objects doesn't affect the raw data in the same way. These applications don't require you to set the resolution when you create a new file, either – it's only necessary when you come to export. When the time comes, choose 300dpi.

It's all well and good having a bleed area, but you still want to know where the edge of the page and the safety area are. Xara shows

Right-clicking the Ruler reveals options to calibrate it in millimetres, so you can zoom in and position the guides accurately.

When creating a template for folded and multiple-page documents, it's best to check with the printing company how best to submit the artwork. For a single folded page you'll probably want to create the design as it appears folded out, in which case you can simply add a guide to identify the fold. Make sure the front and back of the design are labelled in a way the printer recognises to avoid the paper being folded the wrong



way. For designs that involve multiple sheets of paper, again, check with the printer. Saxoprint requests that pages are numbered as individual files.

IMAGES AND EXPORT

Regardless of whether you're working in desktop-publishing or image-editing software, you'll need to keep an eye on the resolutions of imported images. As we mentioned above, 300dpi is the standard resolution for print. Some people are happy to drop to 250dpi or even 200dpi, especially for posters that will be viewed from a few feet away, but as a rule we'd stick to 300dpi.

That's easy to achieve with today's high-resolution cameras. An A4 page is 297x210mm, or 11.7 by 8.3 inches, so you'd need a 3,510x2,490-pixel image to cover the page at 300dpi. That's only 8.7 megapixels. However, while the average SLR or CSC photo will look great printed at A4 size, a 12-megapixel smartphone snap might not be so impressive if details are obscured by noise-reduction processing.

It's rare for printed documents to use full-page photos, though, so you're on safe



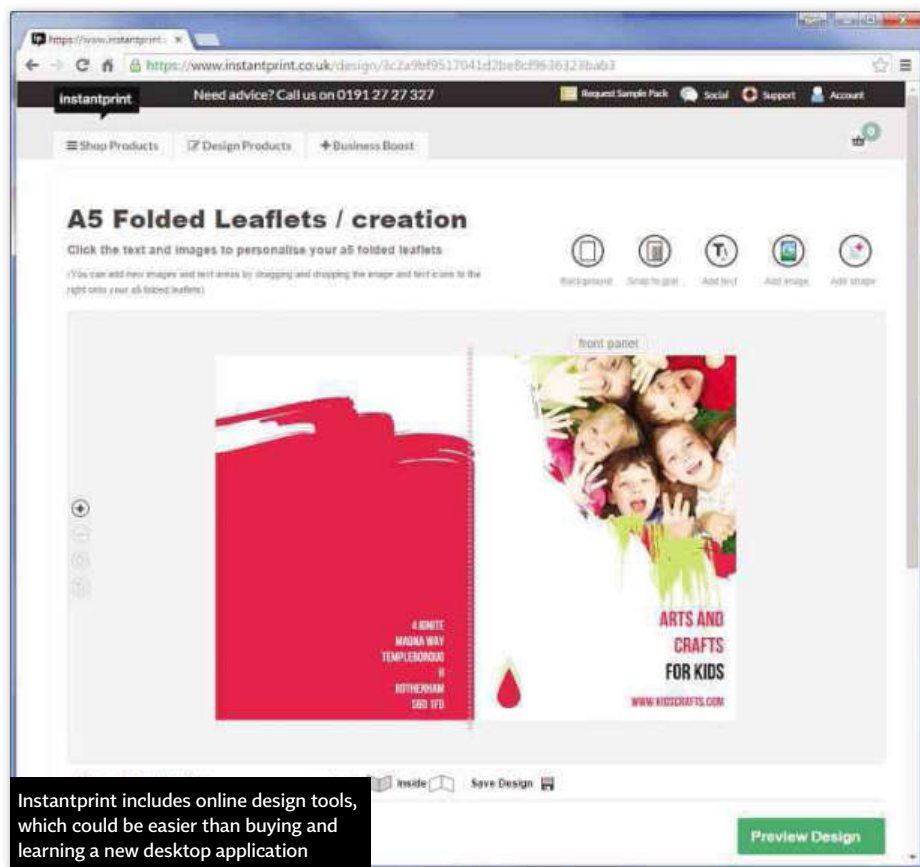
ground with smaller images that appear on a section of the page. Steer clear of images taken from websites, though – not just for copyright reasons, but also because they tend to be small and heavily compressed. We talked to Jeff Chaplin from Urban Design & Print, who told us that the most common problem for submitted designs are images that are too low resolution.

If you're in need of high-resolution images, check out our article on using other people's images legally in *Multimedia Expert*, *Shopper* 325. While you're locating back issues, also pick out issue 331, where we gave a crash course in the finer points of desktop publishing.

Another thing to think about is colours. Cameras record images and monitors display them using red, green and blue (RGB) colour channels. Printers, on the other hand, squirt cyan, magenta, yellow and black (CMYK) ink. These two colour modes have a slightly different gamut – that is, there are certain tones that can be described by one but not the other – and there's no standard way to convert from one to another.

If artwork arrives at a commercial printer in RGB format, the first thing they'll do is convert it to CMYK. This can lead to skewed colours, and the exact nature of this skew will vary from printer to printer.

As such, it's best to perform the CMYK conversion yourself. Unfortunately, this is something that's generally only available in pricier versions of software – Photoshop CC but not Photoshop Elements, Xara Designer Pro but not Photo & Graphic Designer. It's not a disaster if you submit in RGB format, but



any later time if necessary). Any RGB photos will be automatically converted to CMYK when you paste them in.

Most printers will accept artwork in Photoshop's native PSD format, but it's important to flatten the file to a single layer to avoid elements become corrupted or lost. In fact, the safest way to submit artwork is in

virtually all professional desktop-publishing applications do, but consumer-level ones don't. Regardless, we'd still recommend exporting in JPEG format, as once again it reduces the chances of mistakes. Jeff Chaplin from Urban Design & Print described how his company had a recurring problem with the Arts Council logo, which mysteriously disappeared from documents, even when it had been submitted by different clients. Flattening artwork to JPEGs removes any chance of this kind of problem.

If you're not in the mood to learn a new DTP or image-editing application, Instantprint has an option to create designs directly in a web browser. Click the Design Products tab at the top of the page and select from compliment slips, flyers, folded leaflets, business cards and letterheads. You'll then be offered a range of templates to kick-start your design, or you can create a design from scratch. The design can incorporate text, uploaded images and simple shapes such as rectangles, circles and stars. There's a basic snap-to-grid function to keep things aligned, and the web application will alert you immediately if you enlarge an image too much. These design tools are pretty basic, but it's a good way to get quick results and to ensure that your design fits the template. **ES**

The safest way to submit artwork is in JPEG format. There's nothing complicated or clever about a JPEG – each pixel has a colour, and that's it

you'll have less cause to complain if colours don't come out as you expect.

To work in CMYK format, open photos in an image editor and locate the menu option to convert them to CMYK. In Photoshop CC you'll find this under the Image menu, Mode. You can then perform any colour correction that's required to this CMYK image before importing it into desktop-publishing software.

If you're laying out your design in Photoshop, set the document's colour mode to CMYK when you create it (or at

JPEG format. There's nothing complicated or clever about a JPEG – each pixel has a colour, and that's it. Therefore there's no risk of fonts going missing, layers being read incorrectly and so on. Set the compression quality to 100% to avoid compression artefacts, ensure that you're saving in CMYK format (if your software supports it) and you're good to go.

The only slightly nerve-wracking thing is that some software displays CMYK JPEGs incorrectly. If you viewed your ready-to-send CMYK JPEG in Picasa, for example, the colours would look very odd. Windows Photo

Viewer handles these files correctly, though.

For desktop-publishing documents, the colour mode is defined when you come to export, so select CMYK on export if it's available. PDF is often used to send artwork to printers, but beware that there are masses of variations to the PDF standard. PDF/X is the one to go for if your software supports it;

NEXT MONTH

IMPROVE YOUR VIDEO SOUNDTRACKS

From capturing dialogue on location to adding narration and music, we explore ways to liven up your video projects



Desktop publishing with Quark DesignPad

Is an iPad really up to the demands of desktop publishing? **Ben Pitt** takes Quark's design app for a test drive to find out

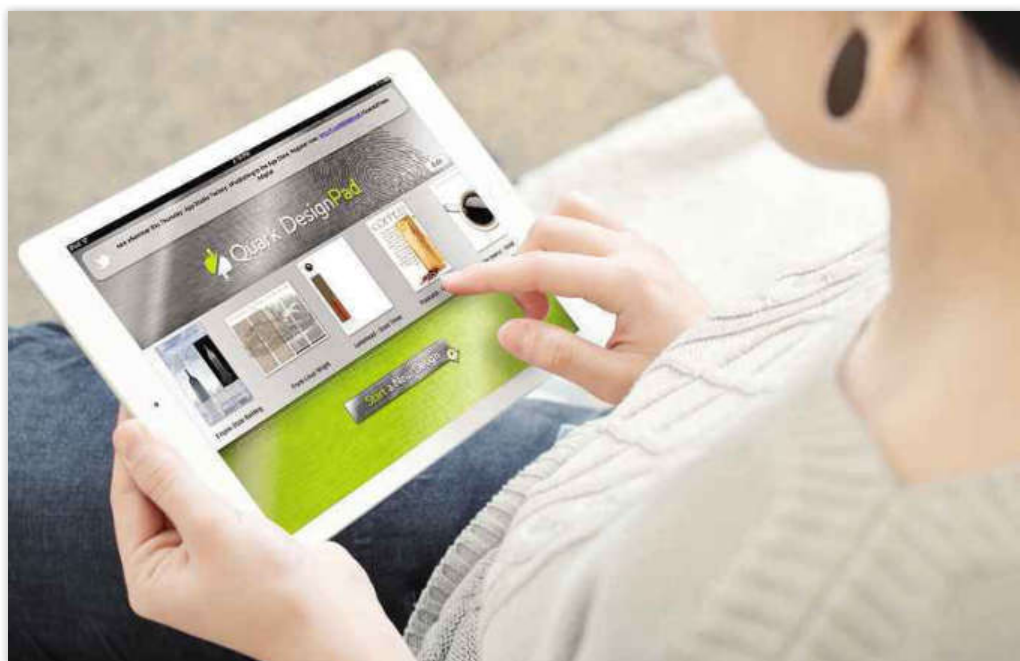


INCREDIBLY, MICROSOFT WINDOWS has been around for 30 years, and some of the stalwarts of media-production software – Photoshop, Cubase, QuarkXPress – aren't much younger. Some people would argue this maturity makes them refined and packed with useful features, but to others they're bloated, overly complex and set in their ways. There's some truth to both viewpoints.

Creative apps for iOS and Android are rarely stuffed with features, but this often works to their advantage. They can distil the production process down to its fundamental components, and reinvent the user interface to give a much shallower learning curve. The fact that the apps only cost a few pounds adds to their appeal, too.

DesignPad (tinyurl.com/334designpad) is a case in point. It's a desktop publishing (DTP) app for the iPad from Quark, the company behind QuarkXPress. QuarkXPress costs £799 and is designed for professional publishing. DesignPad is free, but a £7.99 in-app purchase is required for PDF exports. This also unlocks a few extra functions, but the free version is fine for casual use, with PNG exports at 150dpi – not quite enough for high-quality prints, but fine for viewing onscreen. It also serves as a working demo for the app.

DesignPad isn't merely a consumer-orientated app. Quark suggests that it could be used by QuarkXPress users to try out layouts quickly, perhaps in collaboration with a client. Even without the in-app purchase it's



The app can handle multiple-page documents such as newsletters, but it's not so good at text that spans multiple columns (more on this below). It can also be a little slow to respond. It's compatible with any iPad running iOS 7.1 or later, but we found it a little lethargic on our third-generation iPad, and we wouldn't recommend it on first- and second-generation models.

brochure, business card, letterhead and poster. Each one has a single default layout, but these can be customised. Each document type comes with various preset size options; tap the Size button near the bottom-left of the screen to see these. You can also enter a size manually with the sliders or by typing in a value. It's useful to choose a reasonably large template to give some space to experiment with the app's features; we've gone for Newsletter, A4 Portrait.

Tap the Layout button to start working on your design. Rather than adjust text and image boxes manually, the layout is defined using 16 sliders and switches. In the top-left corner there's a button to randomise the controls, plus another to remove all content from the current layout. The latter is useful to help see how the various controls work. Over to the right, the grid icon toggles the guidelines on and off. Showing them makes it clearer what's going on as the layout is adjusted, but hiding them gives a much neater view of your design.

The top slider on the left sets the margin width in inches, and the next two set the horizontal and vertical gaps between columns and rows. Next up is the number of columns per page, followed by the number of rows.

DesignPad helps less experienced users achieve polished results with remarkably little effort, while still affording precise control as and when it's needed

possible to export in native QuarkXPress format for further editing on a Mac or PC.

Most importantly, DesignPad helps less experienced users achieve polished results with remarkably little effort, while still affording precise control as and when it's needed. Various basic principles of design are built into the interface, and users can generate attractive layouts simply by adjusting sliders.

It's not perfect, then, but there's a lot that this little app can do. So without further ado, let's take it for a test drive.

LOCK TO THE GRID

The app starts with a file-management page where you can create, duplicate or delete documents. Tap the + icon to start a new design and you'll be greeted with 11 types of printed document to choose from, including

As a rule it's best to break A5 and bigger pages up into multiple columns. For example, *Computer Shopper* is mostly laid out with a three-column grid, though some news stories are two-column and *Zygote* (see page 146) is four-column. Don't divide the page into rows just yet; that can happen as content is added.

The next set of controls defines the text and picture boxes that are inserted into the grid. The first control, represented by a box with an X inside, is for a background image or colour fill, which can either be full- or half-page. Next comes the header size, where the main title for your document would go.

boxes. Sometimes they throw up odd results but with a bit of experimentation it's possible to generate something that's smart and functional. If you're particularly pleased with the result, tap the folder icon towards the top-left to save your layout as a Layout Preset.

MANUAL TWEAKS

Some layouts will require some manual tweaking. For example, we placed a

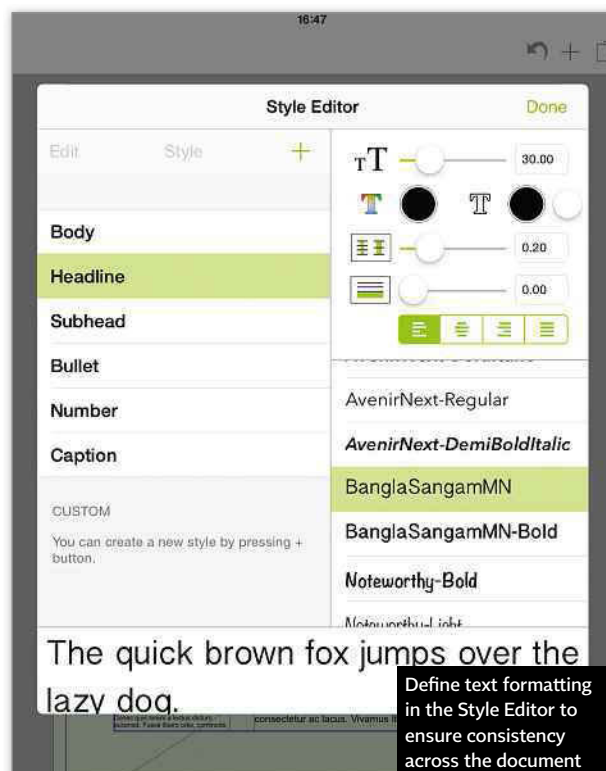
Consistent formatting of text is a key ingredient for a professional-looking document, and DesignPad offers three ways to manage text

Paragraph text boxes can also have headlines, but we'll get to that later. The header only appears after you've added some text and picture boxes. The layout automatically changes to accommodate the number of boxes you request, although the app can behave a little erratically and not give you exactly what you asked for.

The single switch toggles between images that stop at the margin and that extend all the way to the edge of the page. Next there's an opportunity to set the size and position of caption boxes. The remaining four controls shuffle the existing content in various ways, making boxes span multiple columns or rows and changing the layout of the boxes. These controls are dynamically linked to the numbers of grids, rows, text boxes and picture

background image on the bottom half of the page but it doesn't align neatly with the boxes. These kinds of changes are possible at the next stage of editing, but it's not possible to come back and amend the layout using these sliders. As such, it's worth getting the design to a reasonably complete state before tapping the Add Content button.

After you've clicked Add Content, boxes can be moved freely by dragging them around the page. However, it can be tricky to keep everything aligned to the grid. We found it easier to use the control that appears in the bottom-right corner when a box is selected. This moves boxes around by default, but tap the centre and it switches to resizing them.



Define text formatting in the Style Editor to ensure consistency across the document

This control makes it easier to perform precise adjustments compared to dragging.

It's also possible to add more boxes using the + button at the top, to delete them with the dustbin icon at the bottom, lock their size and position (but not content) with the padlock, switch between text and image content and reset their size and position using the crosshair. There are buttons to change the layer order, too.

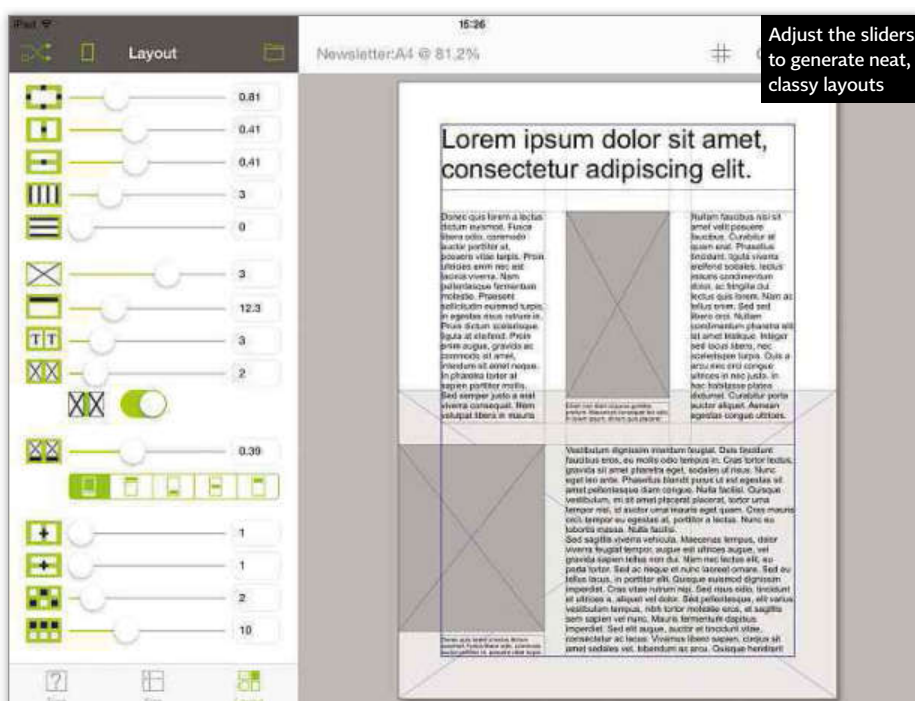
FORMATTING TEXT

A consistent layout is one key ingredient for a professional-looking document. Another is consistent formatting of text. DesignPad offers three ways to manage text: Style, Pattern and Custom. Tap a text box to select it and then tap the button marked T to see these options.

The Custom tab provides direct access to the font, size, space between lines, space at the end of paragraphs and justify settings. However, if you want to maintain consistency across the document, it's best to use the Style tab and tap Edit Styles. Here you'll find the same options, but adjustments are applied to all text boxes with the same Style applied. It's also possible to define new styles if you need more than the six that are supplied.

Some text boxes require a mixture of styles – perhaps a headline and body text. These are created using the Pattern tab. Again, various preset combinations of styles are provided, and you can make your own using the Pattern Editor.

Once your formatting is done, it's time to import or type in your content. Tap to select a text box, then tap the Pen icon to enter text. Where a Pattern has been used, there will be separate sections to enter text for each Style.



Adjust the sliders to generate neat, classy layouts

One weakness with the app is that it lacks the ability to link text boxes so the text flows from one box to another. Hopefully this will be resolved, but in the meantime it's easiest to have a single text box per article rather than have them span multiple columns. That's usually not an issue for flyers, business cards and so on but could be a pain for newsletters.

It's also frustrating that text isn't edited in place. Instead, a pop-up editor shows the raw text, so it's only after you finish editing that you see how well it fits the text box. It's good practice to make text fill the box so the bottom edges of multiple boxes are aligned, but achieving this via the pop-up editor isn't easy.

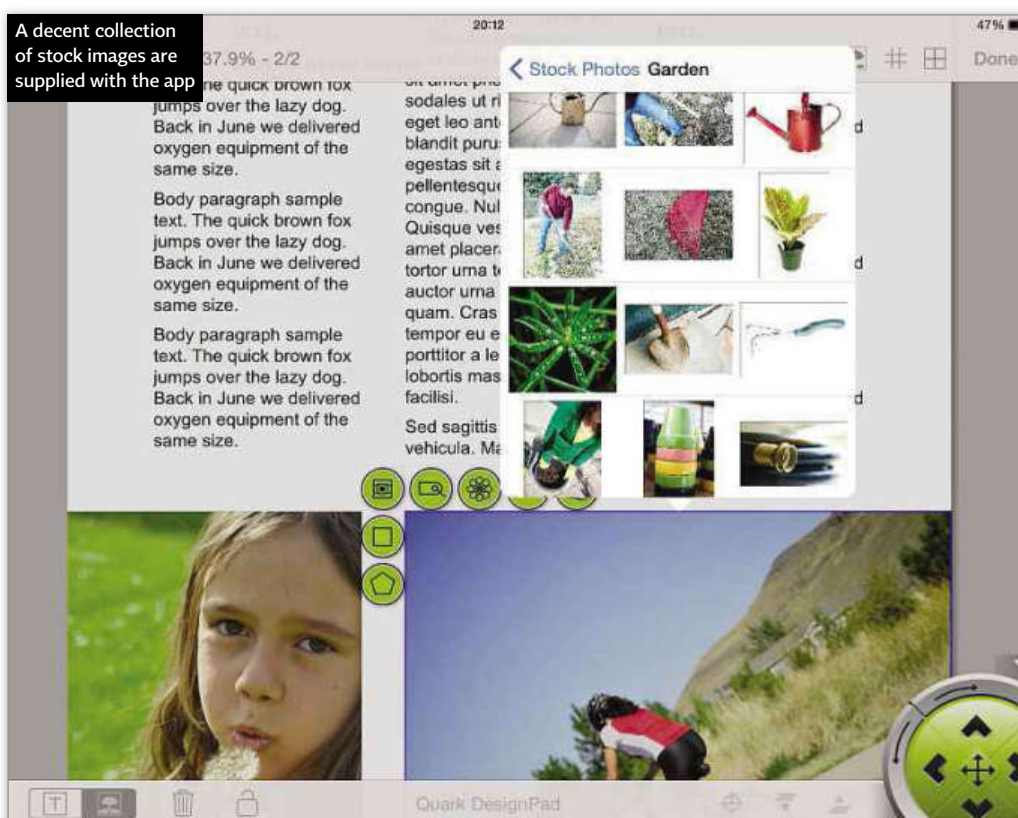
One saving grace is the red button that appears at the bottom of boxes where the text overflows the box. Tapping this button resizes the text to fit, but the downside is that font sizes in different text boxes will no longer match. If you have the patience to edit the words so that they fit the box perfectly, you'll end up with the best results.

SPLASHES OF COLOUR

Virtually any document will benefit from some colour on the page. DesignPad supports coloured boxes, simple drawings and photos, with the latter imported from the Camera Roll or the app's library of stock photos.

Tap a picture box and tap the cloud icon for stock photos or the flower icon for your own from the Camera Roll. Images are sized automatically to fill the box, so you'll lose some of the photo if it's a different aspect ratio to the box. To pan and zoom the photo without changing the box dimensions, tap and hold the image until a tick icon appears. We found moving and resizing images to be temperamental when attempting to drag and pinch them. The control in the bottom-right corner is easier and more precise.

A decent collection of stock images are supplied with the app



Boxes can also have a colour fill. Select a box and tap the square icon to set a fill, outline, transparency and a drop shadow. These are available for text boxes as well as image boxes, which can help text stand out from the rest of the page. It's worth revisiting the text-formatting options and applying a margin to the text box so the coloured background extends beyond the text itself.

Boxes aren't limited to being rectangular. Tap the pentagon button for options to create

boxes with curved or stepped corners, triangles, ellipses, speech bubbles, polygons and wavy-edged shapes. As a rule, the more unusual shapes are less useful if you want to keep things looking professional. Boxes with curved corners can work well, though.

MULTIPLE PAGES AND EXPORT

For documents with more than one page, tap the icon towards the top-right corner that shows two overlaid rectangles. This takes you back to the Layout Designer, where you can define the number, size and distribution of text and image boxes for an additional page. The settings for the previous page are loaded up by default, but you may want to shuffle the order or lose the main heading.

Exports are via the top-left button, with options to save as a PDF (with an in-app purchase), PNG image or in native QuarkXPress format. The exported files can be emailed or saved to the Dropbox or Box cloud storage services.

That's pretty much the extent of the app. As we mentioned at the start, DesignPad doesn't try to be all singing and dancing, and instead delivers simple design tools that help people get presentable results quickly. Its text input has some room for improvement, but otherwise DesignPad is an impressive and innovative app. **CS**



NEXT MONTH

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Zygote

An iPhone case shaped like a handgun may be scaring Canadian beach-goers, but **Zygote** has something far more terrifying on his mind: an immortal Noel Edmonds

STUNNING NEWS

A 34 year-old nitwit from Winnipeg thought it would be a good idea to tote an iPhone case in the shape of a handgun, then go to the beach on a fine Sunday afternoon with it tucked into his shorts. Unsurprisingly, several members of the public grew alarmed when they saw him wandering around the shoreline, and called the Royal Canadian Mounted Police to say there was a terrorist in their midst.

Within minutes, the beach was swarming with Mounties armed with rifles and tasers, who found the suspected assassin sitting quietly with his wife and children eating a picnic. The Mounties gave him a severe ticking off and confiscated the offending item, saying he was lucky not to be living 60 miles south across the US border, where he would probably have been shot by the feds.

For the purposes of research and 10 Nectar points, Zygote has just ordered an 'iPhone gun-style case in silicone rubber' on eBay for a tenner, to be turned over to the local constabulary for their comments when it arrives. But the real shocker is the discovery that Amazon is flogging an 85 quid stun-gun iPhone case that packs a 950,000-volt punch. You would either have to be very scared or very brave to tote one of those in your beach shorts.

PHONE TAPAS

Recent holidaymakers to Spain may have bought back an unexpected souvenir to go with the sombrero and suspicious rash. When many visitors land in Iberia and switch on their mobiles, tablets or laptops, their default network is automatically pushed to Vodafone Spain.

There's nothing wrong with that, apart from the fact that Vodafone Spain uses special cookie tags that automatically monitor every request made via its network. Unlike conventional cookies, there's no opt-out and

they can't be cleared once they have self-installed. Instead, they stubbornly cling on and build up a complete profile of the user's online habits. They then grant access to advertisers, with Vodafone taking a cut of the advertising revenues. The only way to prevent this happening is to access nothing but secure websites with the HTTPS prefix, or refuse to connect to Vodafone Spain in the first place.

HEAD EXAMINED

Yet another example of the Bleeding Obvious has been published by technology boffins, this time from the London School of Economics. After exhaustive research carried out in a large number of schools across London, Manchester, Birmingham and Leicester, the experts have conclusively proved that students get better exam results when mobile phones are banned from the classroom.

Their research states that in schools where students are allowed to pocket-fondle their mobiles during lessons, they experience less teaching because they get distracted by the banalities of the small screen, and consequently the proportion of good passes at GCSE is lower. Coming soon: researchers discover that dead people can't speak French.

BOTTOM LINE

The world's greatest bearded philosopher has declared that using a special Android tablet device has changed his life. The electronic marvel is called an EMPpad and the philosopher is none other than that bloke off the telly, Noel Edmonds.

"The biggest problem in the world is electro-smog, caused by Wi-Fi," says the former partner of Mr Blobby. "Everything is about energy. There is no such thing as death. You cannot die. It's been known for a very long time."

Mr Edmonds has recently published *The Positivity Formula*, and reckons that using an EMPpad for eight minutes a day "recalibrates all the blood cells and the electro-magnetism in the body". In this way, his energy will become immortal and "return to where it came from", presumably up his own Crinkley Bottom.

What Noel Edmonds failed to mention is that his EMPpad will set you back two thousand quid, and uses the web to promote his immortal philosophy, thereby creating the very electro-smog it is supposed to cure.

MIND OUT

The BBC is hard at work on a wearable remote control unit operated by thought control. The device is clamped across the forehead by a simple plastic

gripper, from where it can read pulses generated by the brain. Early trials have demonstrated that the gizmo actually works, and Cyrus Saihan, the head of business development of the BBC Digital Division says: "Imagine a world where instead of having to get up from your sofa, or reach for your remote, you just think – turn the BBC on!"

Zygote can hardly wait and, having suffered the interminable repeats that infest the schedules of BBC Three, welcomes a device that responds to the thought, "now turn it off!"

FOOD FOR THOUGHT

There is sinister new hacker in our midst. In fact it could be lurking in your kitchen right now, waiting to steal your identity and wreak havoc. It is your fridge. The Samsung 4-Door internet-connected refrigerator with Wi-Fi enabled LCD messaging can be controlled by the Samsung Smart Home app to wage cold war against you. The app connects to Gmail calendars, which is nice, but fails to validate the security certificates that normally protect login credentials, which isn't nice.

Zygote knows it's corny, but as sure as eggs is eggs, unless you know your onions, this can spill the beans, piss on your chips and make things go pear-shaped. And that's a recipe for disaster. **CS**



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